DOCUMENT RESUME

ED 247 375 CE 038 866

TITLE	Development of Curriculum for a Non-Traditional Machine Tool Technology Program Accessible to the Physically Handicapped. Dissemination Report.
INSTITUTION	Chabot Coll., Hayward, Calif.
SPONS AGENCY	California State Dept. of Education, Sacramento.
PUB DATE	[80]
NOTE	115p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC05 Plus Postage.
DESCRIPTORS	*Accessibility (for Disabled); Adaptive Behavior (of Disabled); *Curriculum Development; Demonstration Programs; Machine Tool Operators; *Machine Tools; Machinists; *Numerical Control; *Physical Disabilities; Postsecondary Education; *Technical Education; Two Year Colleges
IDENTIFIERS	*Chabot College CA

ABSTRACT

This report of a project to develop curricula for a model program for computerized numerical control in the machine tool technology area begins with a discussion of accessibility in vocational/technical programs. An overview of the laws requiring program accessibility is provided. Problems encountered in program accessibility and their solutions are then analyzed. These problems include architectural versus psychological barriers; how to adapt the person to the environment versus adapting the environment to the person; how to select, counsel, and direct physically limited students into appropriate jobs in industry; and how to foster skills needed for independent living beyond school. Introductory materials include a synopsis, a short history and the state-of-the-art of numerical control, and the philosophy for teaching numerical control. These curriculum materials are then provided: a complete layout of the units, course requirements, time frames, and course outlines for all certificates and degrees in Machine Tool Technology at Chabot College. Sample class assignments, tests, and lab layout follow the course outlines. Appendixes include a synopsis of laws, descriptions of aids, information on insurance rates and tax benefits when employing handicapped persons, and a sample job analysis. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED247375

DISSEMINATION REPORT

Development of Curriculum for a Non-Traditional Machine Tool Technology Program Accessible to the Physically Handicapped

Prepared by

South County Community College District

Chabot College, Hayward, Ca.

under a

VEA SUBPART 3 GRANT

Project Director

Robert N. Brown

Project Administrator

Richard Moore, Enabler

Associate Dean of Natural and Applied Sciences

Robert G. Hunter

CE 038 866

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

R Hunter

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

TABLE of CONTENTS

		page
I.	INTRODUCTION	
	A. A Look at the Future	1
	B. Abstract of the Project	3
II.	PROGRAM ACCESSIBILITY	
	A. The Laws requiring Program Accessibility	5
	B. The Problems encountered in Program Accessibility	6
	C. The Solutions realized from this Project:	
	(1) Architectural vs. Psychological Barriers	7
	(2) How to adapt the person to the environment vs. the environment to the person	9
	(3) How to select, counsel, and direct physically limited students into appropriate jobs	12
	(4) Skills for Independent Living	14
III.	CURRICULUM FOR A MODEL MACHINE TOOL TECHNOLOGY PROGRAM	
	A. What is Numerical Control?	
	(i) Synopsis	16
	(ii) A Short History	17
	(iii) State of the Art today	19
	B. Program Structure and Teaching Philosophy	22
	C. Courses, Degrees, Certificates	25
IV.	APPENDIX	
	Section A — Synopsis of Laws	62
	Section B — N/C Machines & Controls Manufacturers	68
	Section C — List of Aids	69
	Section D — Insurance Coverage	81
	Section E — Tax Benefits	85
	Section F — Sample Job Analysis	87

ACKNOWLEDGEMENTS

This report is the product of two years of concentrated effort by many interested people. I would like to list them in the chronological order of their involvement and at the same time thank all the people whose patience and efforts made this project possible:

Dr. Reed L. Buffington, Superintendent/President, Chabot College

The Board of Trustees, South County Community College District

Cathy Noble, Coordinator, Physically Limited Student Resource Center, Chabot College

Ann Steiner, Job Development Specialist, Center for Independent Living Berkeley, Ca.

Neal Jacobsen, Computer Specialist, Center for Independent Living, Berkeley, Ca.

Robert G. Hunter, Associate Dean of Natural and Applied Sciences, Chabot College

Dr. Richard D. Yeo, Dean of Instruction, Chabot College

Richard Moore, Enabler, Physically Limited Student Resource Center, Chabot College

Sharon Trethan, Purchasing Agent, Chabot College

Rita Goldhor, Secretary for the Project, Chabot College

Ken Kennedy, Student/Guinea Pig, Chabot College

Maurice Leblanc, Stanford Children's Hospital, Palo Alto, Ca.

Wallace Matlock, Stanford Children's Hospital, Palo Alto, Ca.

Gordon Stout, University of California, Berkeley, Biomechanics Lab.

Don Van Horn, Sensory Aids Foundation, Palo Alto, Ca.

Summit Services Co. Inc., 535 Division Street, Campbell, Ca.

Dave Martin, Tektronics Co., Santa Clara, Ca.

Cliff Oliver, Instructor, Chabot College

Dave Pasarell, California Community Colleges, Sacramento, Ca.

William Anderson, California Community Colleges, Sacramento, Ca.

Helen Jones, Enabler, DeAnza College, Cupertino, Ca.

Rod Carter, Counselor, Oakland, Calif. State Department of Rehabilitation

Erik Ziebarth and all other students who made commendable efforts to help their handicapped peers enjoy this, our first, year of accessibility.

I.
INTRODUCTION

Pages 1-4

I. INTRODUCTION

A. A Look at the Future

Visualize, if you will, a scene that depicts a futuristic factory, producing parts for astromobiles to be used by man in a brave new world.

In this factory, none of our traditional stereotypes of factory workers and large greasy machines exist. Instead, we see a clean, mind-boggling array of highly technical mechanisms being controlled by the artificial intelligence of a robotic workforce.

From a fiery furnace, hot steel is extracted by a computer controlled, asbestos shielded robot; the robot takes the hot ingots of steel to a fully automated forge that hammers the metal into the rough shape of a part. When cooled, the part is automatically conveyed to the lathe section of the factory.

Here, we see a battery of metal turning lathes being controlled by a computer that has been programmed by a blind woman in a glass room 2,000 miles away. Robots, with nine degrees of function and movement, carefully and accurately load the parts into the computerized lathes. The lathes start up, and with little human involvement beyond programming, turn out finished crank shafts to be used in astromobiles.

In another part of the factory, parts from all section of manufacturing are being assembled and tested. Robots with sight, feel, and extremely accurate motor movements are assembling the pistons to the crankshafts to the engine block, painting fenders, welding frames, stitching upholstery, and wiring all the electronic circuits together. Periodically, in this cycle, a man who is paralyzed from the waist down drives through the area in a special wheelchair that elevates him to any level needed to check the operation of the system. This same man can program and edit the programs that operate the computer that controls the machinery and the robots.

At the end of the assembly line, finished astromobiles roll off to be sold throughout the world.

Far fetched? Beyond practical belief? Not really, when you consider that 90% of this desciption is already a reality at Toyota Motor Works, Ltd. and Fugitsu Fanuc Ltd., in Tokyo, Japan.[1] The technology of computer controlled machinery and robotics is well known and widespread in the industrialized world.

The 10% of this scene that is only partially a reality is the blind woman who programs the computers and the crippled man who operates and checks the equipment. From what we have seen in our work at Chabot College this year, we may as well include these as a reality also.

To someday be able to realize this scenario and its integration of modern technology for the good of all people, steps must be taken to direct our school programs toward teaching the latest in technology to all people who desire to enter the new jobs industry is offering.

This report is dedicated to opening doors to new technology to all people who wish to pursue it.

1) American Machinist, November 1975.

I. B. Abstract of the Project.

Two forces were behind the proposal of and the work done under the VEA Subpart 3 Grant entitled "Curriculum Development for a Non-Traditional Machine-Tool Technology Program Accessible to the Physically Handicapped."

First, as is brought out in our introduction, we are entering an era in industry where small, relatively inexpensive computers are being linked to standard machine tools of all types in a general science called Numerical Control. To the extent that it is economic to employ them, robots are also being tested and used to increase productivity and eliminate human involvement where hostile environments and tedious work situations exist. The jobs that result from this shift to Numerical Control of machines and robots are Computer Programming, Machine Operation, Computer and Machine Maintenance, and Systems Control and Analysis; this situation parallels almost exactly that seen in the field of business in the last 15 years, where the computer is now programmed to run banks, control the operation of large multi-national corporations, or just give a clear, concise financial statement of the dealings of the corner bakery.

Whenever we see a computer or robot take the job of a human, we immediately object; "where will these displaced workers find employment now?" is our first question. It is now, and has always been, the role of post-secondary education to lead the way for implementation of leading edge technologies. Numerical Control is no exception. In our Vocational-Technical Training of the people who will live and work in this brave new world, we must change our teaching and curriculum to service the needs of our constituency. The current need is, as our work has shown this year, to train people who can program these machines, operate them, maintain their complex circuits and mechanisms, and be responsible for entire manufacturing systems that employ them. There are easily as many new jobs in these areas as we are replacing with our computer technology.

The second force behind this project is the mandate of the recent requirements of Section 504 of the Rehabilitation Act of 1973 that, by June of 1980, all programs offered at the college level as well as all other levels, must be accessible to all people regardless of physical handicaps. That includes all programs in the Vocational/Technical fields which have heretofore been almost completely inaccessible. Of these fields, the hard technologies - those that pay the highest and require the most physical involvement, such as welding, electronics, machine tool technology, automotive technology, drafting, and many others - offer the biggest challenge for compliance with these new laws.

Our project, then, was to combine these two forces and develop curriculum for a model program for Computerized Numerical Control in the Machine Tool Technology area. This model program could become the catalyst for other programs, which would breed other programs, until the hard technologies would truly be accessible to the handicapped person, as well as meeting the advanced needs of industry.

II.

PROGRAM ACCESSIBILITY

Pages 5 - 15

II. PROGRAM ACCESSIBILITY: VOCATIONAL/TECHNICAL PROGRAMS

A. The Laws requiring Program Accessibility.

Schools and all Public Institutions that receive federal assistance are now subject to the terms of Title V, Section 504, of the Rehabilitation Act of 1973 (Public Law 93-112) which was enacted on June 3, 1977. In addition, most preschool, primary and secondary schools are also subject to the terms of the Education for All Handicapped Children Act (Public Law 94-142) which was enacted on October 1, 1977. These are powerful laws because they hold as incentive for compliance the very federal financial assistance that keeps our programs alive. In other words, public schools could lose their federal funding if they don't comply with these laws; and compliance must be complete by June 1, 1980.

As with all new laws, there are many grey areas that need explaining; there are many terms that need interpretation; there is much need for research into how we actually live up to the terms of these laws.

Much of what was done in this project this year was directed to the problem of interpretation of the terms and conditions of these new laws. In this report, an attempt is made to interpret these laws as they relate to one Vocational Education area: Machine Tool Technology. These findings, however, apply to all Vocational Education programs, as all these programs have common problems with compliance.

Appendix A to this report contains a brief synopsis of these laws, taken from the HEW pamphlet "Your Responsibilities to Disabled Persons." If you have not read these laws or need more clarification, please read this Appendix section.

II. B. The Problems encountered in Program Accessibility.

The laws are definite in their intent; however, they are vague in their instructions for actual day-to-date compliance in our schools. The tendency is to contemplate spending large sums of money to make buildings and equipment in Vocational/Technical Education usable by the physically handicapped. The tendency also is - and will be - to overreact to such powerful legislation.

The approach to these problems at Chabot College this year was to combat these tendencies and to look for simple, honest, and effective answers to compliance that attack the real problems faced by physically limited students in our high schools, colleges, and universities, and ultimately the businesses and industries that these schools serve. The following is a list of the real problems facing the physically limited student who is contemplating a career goal in any of the technical fields:

1. Architectural vs. Psychological Barriers:
   Which is the bigger hurdle?

2. How to adapt the person to the environment vs. the environment to the person.

3. How to select, counsel and direct physically limited students into appropriate jobs in industry, especially the new technologies.

4. How to foster skills needed for independent living beyond school.

These questions and their solutions are analyzed in the next few pages.

II. C. The Solutions realized from this Project

(1) Architectural vs. Psychological Barriers: Which is the bigger hurdle?

Much research has been done to determine the changes to the architectural environment in schools and industry to accommodate the physically limited person. Virtually all new buildings, for instance, have elevators, special bathrooms, automatic door openers, and other obviously needed corrections to the architectural barriers that exist. These corrections are absolutely necessary to the success of physically limited people who are entering the mainstream of life. However, while we are changing the structure of our facilities, we are doing little to change the way we view handicapped people and their need to be accepted in our circles of society.

Today, the psychological barriers are by far the greatest problem faced by physically limited persons in our communities. What good is an automatic door opener to let someone into a building if the people in that building cannot relate to that person and that person's needs? What can we, as able-bodied people, do to aid in the process of making these people feel a part of what we are doing in our schools, businesses and social groups What can physically limited people do to help others accept them as active participants in our system? As is the case in so many social changes we go through, education is the primary key to the solutions of these problems. Along with education, exposure to the problems holds another valuable key.

In September of 1978, Chabot College actively encouraged interested physically limited students to attempt the courses offered in Machine Tool Technology and Numerical Control Machining programs. Part of the work to be done in this project was to actually have physically limited people try the program and see what the problems would be.

Instructors, counselors, enablers and administrators worked together to raise each other's consciousness of the potential and real problems that, for instance, a blind person or a person in a wheelchair might encounter in a large and active machine shop environment. We first educated ourselves to the needs and limitations of these people; this was done mainly by talking directly to the students with these limitations, and getting a feel for where they are and what their fears about failure, injury or non-acceptance were. It was mainly education by exposure, not just something gained from books or movies (although books and movies help a great deal), that made it possible for us to realize the abilities of these people to succeed in the job market. We were, in effect, attacking the psychological barriers first and then looking at the physical barriers confronting these people.

One of our first candidates to sign up for the program was Ken, a C-5 C-6 quadriplegic who had desired to work in the machine shop/manufacturing arena for years, but was held back by the well-known conditions prior to the 504 legislation.

Ken's first comment to us was that he should not be babied through these courses and specially should not be given special treatment beyond helping him to find the means to do the job. Ken's feeling is that too many counselors and educators make it too easy for persons like himself to stay home and be unchallenged by programs like this one. Ken, like anyone, needed to be told that anything is possible if you want it badly enough, and specifically that to be accepted as a working member of the class would be a challenge for him to do the work as assigned and to keep up with the pace set by other students. If he could do this, he would, more or less, be automatically accepted by his peers. It was then up to his instructors and counselors to find the means to allow this to happen.

Other means would be needed for Erik, our first deaf student, for Don, our first hemipelvectomy amputee, for Manuel, a severe hand injury, or for Jeff, a severe kidney failure student, as well as for Gertrude, a black mother of three, or Scott, a normal, able-bodied member of Chabot's Football Team.

To overcome psychological barriers involved in educating anyone in our classrooms and laboratories today, we simply have to challenge each individual to aspire to the level of competence that he or she desires to achieve, regardless of what their physical, racial or social status is, to the best of our abilities as professionals. And the first step is to accept these individuals for their abilities ourselves, thus easing the way for our students to accept each person for what he or she is and not the physical condition they are in. Then, once you have come to know the person and his case history, the means to help that person become more and more apparent.

One of the greatest thrills for all of us at Chabot College this year was to see just how easily our physically limited students have been accepted - with virtually nothing said to prompt this acceptance.

The feeling of "people helping people" opened more doors this year for wheelchairs than did any mechanical door opener ever engineered.

II. C. 2. How to adapt the person to the environment vs. the environment to the person.

Once you have accepted each physically limited person for his or her potential abilities, and that person has done the same, it is important to develop the means for that person to succeed in the physical tasks involved in the vocational area being studied.

The paramount consideration in determining the means to be used to aid a physically limited student in pursuit of your curriculum is: "Are you creating an environment in your school classroom that is peculiar to just your classroom?" That is to say, "Will this means or solution be commerically

available to your student on the job in industry, or merely something you dream up for this person to aid him in your classroom?"

In addition, we should look to the techniques currently being used by engineers in designing solutions to any problem. Currently the idea is that if, for example, you are trying to filter pollutants out of a river that are caused by a single discharge drain from a factory upstream, you don't design a large, expensive mass filtering system downstream to clear the water, but rather go right to the source of the pollution and design a filter to fit on the end of the drainpipe.

Do you lower everything in the world to wheelchair height, or raise and lower the person in a wheelchair to meet the required height of the job or activity? The best aids or means we can devise, then, are those that affect the person directly; those that can be taken with the person into any environment and used just as they are used in your classroom or laboratory, and those that are commerically available in the community and widely tested in the field.

One notable example of how Chabot College handled just such a problem is in the case of Ken, a quadriplegic. A Mainstream(R) elevating wheelchair was loaned to Chabot College by the manufacturer, Summit Services Co., Inc. for test considerations. Although Ken had plenty of enthusiasm and drive, he could not reach all the handles and levers on the machines from his standard wheelchair height; moreover, it was unsafe for him to be put on wooden platforms or to be propped up in his standard chair. The Mainstream(R) elevating wheelchair and a tool vest gave Ken a commercially available, safe and unobtrusive means to conform to his environment. (See Appendix C)

After completing one year at Chabot College, Ken had a chance to work during the summer at a local machine shop. Ken's counselor at the State Department of Rehabilitation in Oakland came to Chabot, surveyed the situation, and determined

that Rehab could purchase an elevating wheelchair for this client because he was employable. The feeling generally is that while a physically limited person is studying a course in school, the school should buy whatever is actually needed and have it available for use during classes. Later, if the student succeeds in achieving gainful employment, the State Department of Rehabilitation, Medi-Cal, Medicare, CCS or other agencies will purchase the device for their clients' use on the job.

Another example of a personal adaptive device is Don's leg prosthesis. The science of prosthetics and orthotics is well established. Artificial parts for the human body are available commercially for almost any circumstance. These are almost always purchased by insurance companies or State Workers' Compensation as part of a person's rehabilitation. The important idea here is that the prosthesis be fitted well so that the person can use the device all day without discomfort and pain. Don did experience some discomfort with his artificial leg and had to sit down on a stool some of the time. Most technical jobs would allow a person to alternately sit and stand to be more comfortable.

Erik, our deaf student, did not require any adaptive aids per se. Because Erik learned to sign first, at an early age, and then learned to speak quite well, he did not require a communications aid. Also, because Erik realizes that he must help others to help him, he made friends with another student who took notes in the class for him. Later, they would meet somewhere and study together. Interpreters are available at a cost to the school district to do this type of work, but in this case, involving another student (who, by the way, took great pride in helping Erik) was a much more natural answer to the problem.

There were no blind students in our program this year; we therefore did not need adaptive devices for the blind, although these are available.

There are many new and exciting adaptive aids being designed by rehabilitation engineers that can be fitted to the person, thus making that person more normal in abilities and functions on the job. These devices are becoming more well known now, and can be seen and tested at most agencies that deal with this situation in the community. Some of the more notable personal adaptations are described in the Appendix, Section C.

There is money available through the State Department of Rehabilitation, VEA handicapped budgets, CCS, Medicare and Medi-Cal, to purchase these devices.

The best plan we have seen is having each school have the most widely usable aids on hand, and to make these available to students while they are taking courses at the school. Later, provisions can be made for one of the aforementioned agencies to buy said devices for each client on a need basis.

As we review the recent U.S. Supreme Court decision in Davis vs. North Carolina Community College, this point becomes more clear. Schools should not alter their standards, curriculum or equipment (especially in laboratory classes) to meet the needs of the handicapped person; indeed, school districts and industry will be reluctant to bear such a cost. Rather, we must adapt each person to existing environments by providing <u>personal adaptive aids</u> that allow that person to compete in the standard classroom and the real job market.

II. C. 3. How to select, counsel and direct physically limited students into <u>appropriate jobs in industry, especially the new technologies.</u>

<u>Note</u>: Much of the material in this Section, and the Living Skills Section, was gathered from interviews, seminars and workshops conducted for the Chabot College staff by the Center for Independent Living of Berkeley, Ca., who are pioneers in the field of rehabilitation counseling.

Counseling is an ongoing need, which helps the student select the proper program, encourages the development of living skills, and helps with finding and maintaining a job. There is tremendous need for support for the job seeker who has physical limitations. Therefore, much preparation before the interview with prospective employers is suggested, including role-playing and introductory interviews, as well as applying for a variety of jobs which the job-seeker may not even want, but which help the person gain experience with interviews.

The main purposes of placement counseling are to bring the handicapped person up to the necessary skill levels and to prepare him to work through the necessary accommodations with the employer. In an interview, the disability should be discussed only to the extent that it relates to the job; it's a good idea to use lay terms, reinforce positive attitudes by being realistic, and to avoid direct reference to "discrimination." It is very helpful if the employer has some knowledge of the new laws, the good work record of the handicapped, the facts about insurance statistics (Appendix D), other tax advantages (see Appendix E), and the slight accommodations and special problems that apply to handicapped employees. The job seeker should also be able to discuss these intelligently with the prospective employer.

There are some "work disincentives" (though fortunately these are changing somewhat for the better) which a handicapped job-seeker must consider carefully. One of the main problems has been the loss of very inclusive medical benefits, in-home services, etc. which are lost when the handicapped person becomes self-supporting. Even a very substantial salary can't always make up for these.

In California, there is now the possibility of a 9-months trial work period which allows for the benefits to be picked up again immediately if

the job doesn't work out. Also there is a California option based on SSI and SDI, where Medi-Cal and the homemaker chore may continue for eighteen months (with a possible extension to as long as thirty-six months) after employment is obtained; some moneys are placed into an account to be used for the purchase of items needed for the job - such as a modified van, adaptive devices, etc. Financial Advocacy Counseling is definitely recommended before a handicapped person looks for a job, in order to be informed and know what decisions to make.

Another option available to the handicapped employed under certain circumstances is a sliding scale adjustment, under which an individual can still keep Medi-Cal and get some home assistance. This plan works well with people who can only work part-time. It is most important that the handicapped person be well informed of the laws and changes as they develop, not only to know their rights, but also to answer employer concerns.

Workshops with employers are an objective of our ongoing project at Chabot College. A dialogue with employers on all aspects of hiring handicapped students in all fields will be of great value in opening the doors, for the benefit of employees and employers alike.

As a result of an Open House held this year, many additional employer contacts were developed, and we have obtained a sample Job Analysis from a potential employer which can serve as a model; it is attached as Appendix F.

II.C. 4. Skills for Independent Living.

Independent living skills do, of course, overlap with job finding skills and other skills mentioned in the preceeding Section (3). Counseling on an individual basis coincides with the individual student's needs. Overall,

the emphasis is on teaching the student to cope independently with situations as they confront him: managing his personal grooming, his transportation needs, his housing and attendant problems.

Lists of appropriate housing, etc., are available through the Handicapped Student Center at Chabot College, so that the student may attempt to follow through on leads independently. Sometimes a student requires advice on how to deal with an attendant provided to him. Interpreters have to be dealt with in the case of deaf students. If the student can make these arrangements on his own, so much the better. Counselors are available to help in stress situations. As mentioned previously, Financial Advocacy Counseling is recommended before a student gives up his benefits under SSI and SDI, because so much is involved.

Peer sessions for handicapped students can be arranged to help them gain support from each other regarding various living situations.

At Chabot College, we are planning to have three or four Seminars a year dealing with the needs of the handicapped person. These will cover:

i. Career Planning/Job Seeking

ii. Personal Hygiene/Independent Living

iii. Sexuality and Family Planning

iv. Financial Advocacy.

III.

CURRICULUM FOR A MODEL MACHINE TOOL TECHNOLOGY PROGRAM

Pages 16 - 47

III. CURRICULUM FOR A MODEL MACHINE TOOL TECHNOLOGY PROGRAM

A. What is Numerical Control?

(i) Synopsis

Numerical Control, abbreviated NC, is a system of controlling a machine or process through the use of numerically coded information which is the input for the machine's control system. The instructions to the machine are in the form of coded numbers punched into a ribbon of paper tape. The function of the tape may be compared to functions performed on jigs and fixtures of conventional machine tools. The tape can be stored for future use in repeating the same job or process. With some numerical control systems, the coded numerical information is inserted into the control system on punched cards or on magnetic tape instead of punched tapes.

Direct Numerical Control (DNC) systems now exist which connect the machine tool directly to the computer through a typewriter computer terminal. Instructions (programs) for operating the machine(s) are stored in the computer's memory and can be called into use through the computer terminal. This system eliminates the need for tape or card input.

III. A. ii. Short History

There was a time when a company wishing to buy a numerically controlled machine was unable to justify it by normal procedures. Finally, somebody with authority had to say: "Forget the justification. Buy it anyway."

That was probably the way most companies bought their first NC machine, and companies that bought one NC machine soon bought another. The biggest hurdle numerical control faced was the difficulty of proving its total contribution to manufacturing. In an effort to briefly outline this contribution, we refer to Programming for Numerical Control Machines, Second Edition, by Roberts/Prentice, McGraw-Hill Book Company, Gregg Division, 1978. From Chapter 1, "Numerical Control - Past and Present," we quote with permission:

"Today thousands of numerical control machines are in use. Some are in large corporations, and many are in small companies or job shops. The cost of each machine may be under $15,000 or over $2,000,000. They may be used for accurately drilling a few holes in a simple part, or for contour milling a complex shape which is practically impossible to machine by conventional methods. Even though the amazingly rapid growth of N/C machines did not start until about 1960, the achievement was the result of work done by many people, starting in 1947.

1947 was the year in which numerical control was born. It began because of an urgent need. John C. Parsons, of the Parsons Corporation, Traverse City, Michigan, a manufacturer of helicopter rotor blades, could not make his templates fast enough. So, in 1947, he invented a way of coupling computer equipment with a jig borer. Mr. Parsons used punched cards to operate his Digitron system.

" 1949 was the year of another "urgent need." The U.S. Air Material Command realized that parts for its planes and missiles were becoming more complex. Also, as the designs were constantly being improved, changes in the drawings were frequently made. Thus, in their search for methods of speeding production, an Air Force study contract was awarded to the Parsons Corporation. The Servomechanisms Laboratory of the Massachusets Institute of Technology was the subcontractor.

In 1951 the Massachusetts Institute of Technology took over the complete job, and in 1952 the prototype of today's N/C machine, a much modified Cincinnati Hydrotel milling machine, was successfully demonstrated. The term NUMERICAL CONTROL was cointed at M.I.T.

In 1955 about seven companies had tape-controlled machines exhibited at the Machine Tool Show. Most of these were different types of contour-milling machines. Many of these early machines cost several hundred thousands of dollars, and some required trained mathematicians and computers to make the tapes for their complex work. However, the machine tool manufacturers soon realized that N/C was an idea which could also be used in many simpler ways.

In 1960, according to the American Machinist; there were one hundred numerical control machines at the Machine Tool Show in Chicago. Most significant was the fact that the large majority of these machines were for relatively simple point-to-point applications. Many of these machines sold at $50,000 or less, which at this time was quite inexpensive for tape-controlled machines. Sales of N/C machines increased very rapidly, and in 1962 one manufacturer produced a point-to-point N/C drilling machine with locating accuracy of $\pm$ 0.001 in./ft at a price under $10,000.

During these years, and continuing today, the electronics industry was busy. First miniature electronic tubes were developed, then solid-state circuitry, and then modular or integrated circuits. Thus the reliability of the controls has been greatly increased, and they have become more compact and less expensive. At the same time, intricate control systems are being developed to do jobs and perform functions which had never been thought possible. "

III. A. iii. State of the Art today.

The impact of numerical control on almost all aspects of the manufacturing operation is now well known. Over 50% of all machine shop operations are N/C and at Machine Tool Conventions and Shows, over 85% of the machines are N/C. The demand for operators and programmers in this specialty far exceeds the supply and comes from smaller machine shops as well as industries employing over 100 employees, who are mandated to hire the handicapped. Many industries have enthusiastically indicated their desire to hire handicapped persons, because it has been demonstrated that this type of machining is well within their physical capacity to perform.

The state of the art today is again summarized by Programming for Numerical Control Machines, 2nd Edition, by Roberts/Prentice, McGraw Hill Book Co., Gregg Division, 1978. We quote with permission:

"The list of numerical control machines is constantly growing, with several hundred sizes and varieties of machines, many options, and many varieties of control systems available. The sizes range from small 18-in. square tables to "skin mills," with tables up to 6100 mm (20 ft) wide and over 30 000 mm (1-0 ft) long.

Frequently, the mention of tape-controlled machines brings to mind the

metal-cutting machines which will drill, tape, bore and mill. However, there is a constantly widening range of equipment using tape control.

N/C engine lathes and turret lathes are being made by several manufacturers. Tape controlled turret and quick-change punch presses are finding wide acceptance. Other numerical control machines are tube benders, flame cutters, and riveting machines. Tape controlled drafting machines are now quite commonplace and are being used for engineering drawings, as well as for checking complex N/C tapes.

N/C wire-wrap machines make it possible to wire quickly and correctly many varied systems of computers, and other electronic equipment and N/C machines insert components into circuit boards. These circuit boards may have been drilled by a tape-controlled machine with several drill heads, each with multiple spindles. Inspection machines can accurately check the inside and outside contours of curved shapes or center-to-center distance of holes. Other fields in which tape control is being used or explored include programmed inspection of electrical and electronic equipment, welding, lasers, electron-beam cutting and welding, grinding and die-sinking. New applications are constantly being found."

To provide training and instruction for such a bewildering array of equipment may seem to be an insurmountably difficult job, but, fortunately, many of the N/C machines for all kinds of work can be hand-programmed quite simply, and efforts to standardize the tapes and control commands have been quite successful. The basic method of calling for machine action is similar for practically all tape-controlled machines. The courses taught at Chabot College endeavor to cover the needs anticipated in industry, allowing students to gain the knowledge which will help them adapt to the expansions and changes as they apply to particular jobs.

In summary, Numerical Control as a science has come of age, and just in time to aid America's sagging productivity. America has been on a sliding scale downward in overall productivity for some time; this year has been our worst. Some say we are fifteen years from becoming another England. Conversely, Japan, West Germany, China and the U.S.S.R. have up-sloping productivity curves.

Computers and the automated systems they control are a good partial answer to this problem. The rest of the answer lies in educating people in the proper use of these devices to increase productivity, and in mustering the proper attitudes that in the past have made American a world leader in production of goods for herself and the rest of the world.

III. B. Program Structure and Teaching Philosophy.

Drawing from the information given thus far in this report, our philosophy for teaching Numerical Control to an integrated group of students, one that includes women, minorities, and physically limited students, can be broken down into these goals:

1. To offer a complete program of Precision Machining and Numerical Control Operation and Programming.
2. To require a good working background in the basics of conventional machining before the student attempts to program an N/C machine. (Note: To be a good programmer, you must first be a good machinist.)
3. To offer three levels of N/C programming competency:
   (a) 2 axis Slo-Syn, point-to-point } manual programming
   (b) 3 axis Bridgeport CNC }
   (c) 3 axis APT programming for CNC mill - computer assisted programming
4. To have high standards of excellence in both lab. and lecture classes; to not lower those standards for any one student because of physical or mental disabilities.
5. To use standard laboratory apparatus and machines, exactly as they will be found in industry today.
6. To counsel prospective students before they enter the program; to dissuade students who lack the minimum physical motion and strength to be able to success in this trade. (This to be done with simple manipulative tests that show basic minimal motion and strength.
7. To help locate and purchase adaptive aids; however, at the same time,

slowly build up an arsenal of aids at Chabot College that can be checked out during class time, just as tools or Audio-Visual equipment is checked out, and then returned at the end of the period.

8. To have a strong link with industry; to invite portential employers to become more involved with the program and acquainted with the students in the program. (This can be accomplished by holding Open House, and having a strong Advisory Committee).
9. To encourage students to gain Work Experience outside of school hours in local industries. Also, to count Work Experience units as elective credit in our degree program.
10. To require back-up courses in:
    (a) shop math and calculators
    (b) blueprint reading and drafting
    (c) metrology and gaging (metric and inch)
11. To help students become aware of agencies and services available to them that can aid them in areas of:
    (a) acquiring adaptive aids
    (b) financial and legal advocacy
    (c) independent living skills
    (d) job searching skills.
12. To make extra laboratory time available to students who cannot complete their work during regular class time; this is especially important in the beginning of the program, when the concepts and skills needed are new and foreign to the student.
13. To offer a one-year Certificate of Achievement, a two-year Certificate of Achievement, and a complete A.A. degree in Numerical Control Machine Tool Technology.

14. To administer a safety test to all students before any laboratory class begins; to specifically dwell on safety with physically limited students to the extent that additional safety questions and instructions be given them.

15. To encourage able-bodied students to help physically limited students by opening doors, lifting heavy objects when needed, observing their safety practices, and in general helping to make them feel a part of the class as a whole.

These goals were set down before our program began in September, 1978. Before this time, we had no physically limited students in our program. This year, 13% of our first-year students were identifiable handicapped students. In addition, we had a 15% increase in women students, who feel that programming N/C machines is a worthwhile educational goal. Our entire program grew about 40% in total number of students completing the first year series of courses. Full classes were seen in every area; competition grew within each class and generally we witnessed a tremendous increase in enthusiasm among students to learn the latest technology.

When a school opens its programs to minorities, women, and handicapped students, they increase the demands on each instructor to meet the need of these new populations; however, this slight increase in awareness, knowledge, and time is offset by the fact that classrooms are full and classes are not being cancelled. Indeed, these are the new populations that need our services. As Henry Kaiser once said: "Find a need and fill it," and you will have a successful enterprise.

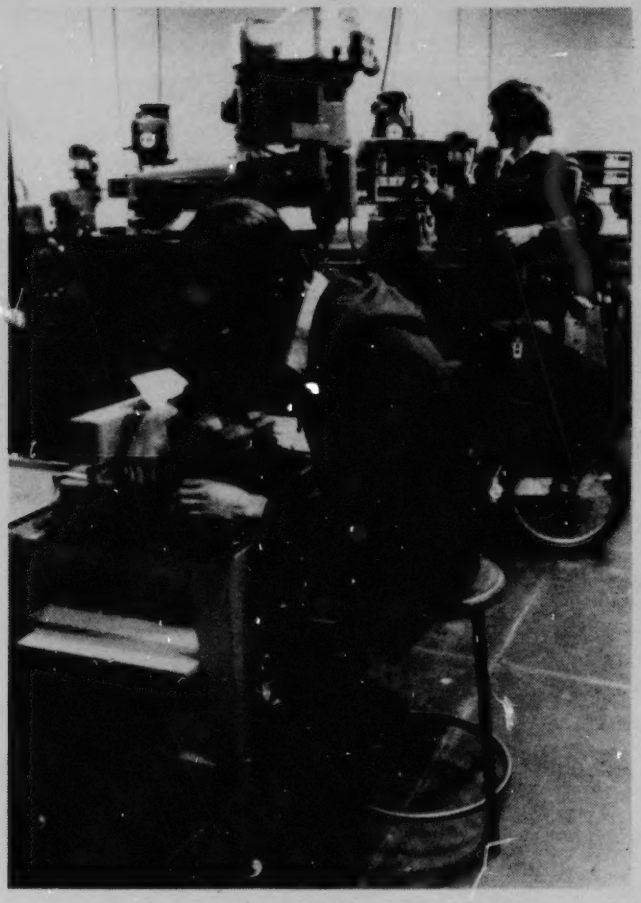
Beyond this consideration, though, is the unmatched thrill of accomplishment experienced when you help someone who really needs your help. When you have helped a paraplegic become employed, or a divorced mother of three find herself and a career, you begin to know what true appreciation of your professional

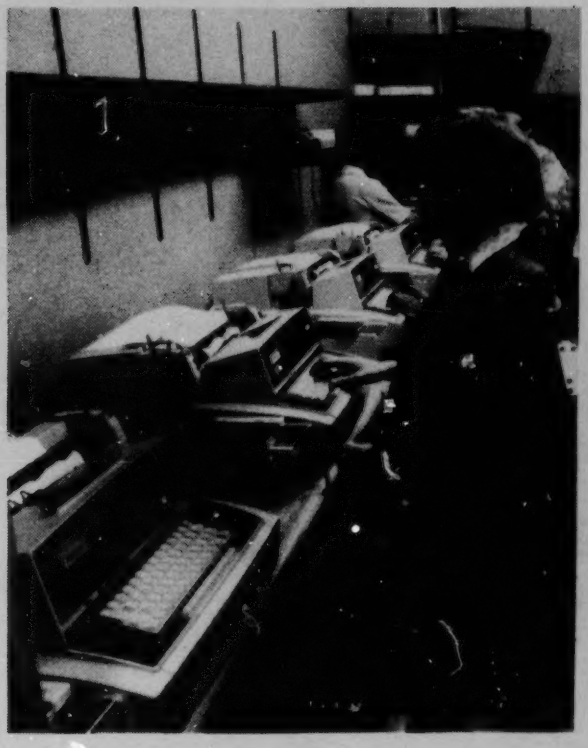
efforts is all about.

III. C. To best explain the structure of our program, the following pages show a complete layout of the units, course requirements, and time frames, as well as the course outlines for all certificates and degrees in Machine Tool Technology at Chabot College.

Sample class assignments, tests, and lab layout follow the course outlines.

CHABOT COLLEGE ANNOUNCES





A NEW AND EXPANDED MACHINE TOOL TECHNOLOGY PROGRAM

FEATURING:

* N/C PROGRAMMING & OPERATION, 2 AXIS, 3 AXIS, CNC, APT
* METRIC & INCH PRECISION MEASUREMENT
* GEOMETRIC TOLERANCING & BLUEPRINT READING
* CALCULATOR SHOP MATH
* TOOLMAKING, PRECISION GRINDING
* STANDARD LATHE & MILL OPERATIONS
* PRODUCTION MACHINING, TOOLING & JOB PLANNING
* MACHINE MAINTENANCE
* METROLOGY & INSPECTION
* SPEED & FEED CALCULATIONS
* CARBIDE & SPECIAL CUTTING TOOLS

33

A.A. DEGREE

MACHINE TOOL TECHNOLOGY

FRESHMAN YEAR	UNITS A	W	S
MACHINE TOOL TECHNOLOGY 60A (Machine Tool Technology I)	4		
MACHINE TOOL TECHNOLOGY 60B (Machine Tool Technology II)		4	
MACHINE TOOL TECHNOLOGY 60C (Machine Tool Technology III)			4
MACHINE TOOL TECHNOLOGY 71A-71B (Tape Controlled Machining)		3	3
DRAFTING 50 (Mechanical Drawing)	2		
INDUSTRIAL TECHNOLOGY 74 (Measurements and Calculations)			3
Physical Education I	½	½	½
English Composition-Speech			
Health Education			
Electives			

SOPHOMORE YEAR	A	W	S
MACHINE TOOL TECHNOLOGY 65 (Production Machining Practices)	4		
MACHINE TOOL TECHNOLOGY 66 (Jigs and Fixtures)		4	
MACHINE TOOL TECHNOLOGY 67 (Applied Machining Practices)			4
WELDING TECHNOLOGY 70 (Introduction to Welding)		3	
ELECTRONICS TECHNOLOGY 70 (Basic Electricity)	2		
Physical Education I	½	½	½
American Institutions			
Natural Sciences			
Humanities			
Social Sciences			
Electives			

FOR SPECIFIC GENERAL EDUCATION COURSES REFER TO SECTION ON GRADUATION REQUIREMENTS

Chabot College A.A. Degree (Total units required -- 90)

N/C PROGRAMMER

	Units
*Machine Tool Technology 60A (Machine Tool Technology I)	4
*Machine Tool Technology 60B (Machine Tool Technology II)	4
*Machine Tool Technology 60C (Machine Tool Technology III)	4
Machine Tool Technology 71A-71B (Tape Controlled Machining)	6
Drafting Technology 50 (Mechanical Drawing)	2
Industrial Technology 74 (Measurements and Calculations)	3
Machine Tool Technology 65 (Production Machining Practices)	4
Machine Tool Technology 66 (Jigs and Fixtures)	4
Machine Tool Technology 67 (Applied Machining Practices)	4
Machine Tool Technology 81A-81B (APT N/C Programming)	6
	41

Total units required - 41
(Certificate of Achievement)

*or equivalent

TOOL MAKER

	Units
*Machine Tool Technology 60A (Machine Tool Technology I)	4
*Machine Tool Technology 60B (Machine Tool Technology II)	4
*Machine Tool Technology 60C (Machine Tool Technology III)	4
Drafting Technology 50 (Mechanical Drawing)	2
Welding Technology 70 (Introduction to Welding)	3
Industrial Technology 74 (Measurements and Calculations)	3
Machine Tool Technology 65 (Production Machining Practices)	4
Machine Tool Technology 66 (Jigs and Fixtures)	4
Machine Tool Technology 67 (Applied Machining Practices)	4
Machine Tool Technology 71A-71B (Tape Controlled Machining)	6
	38

Total units required - 38
(Certificate of Achievement)

*or equivalent

MACHINIST

	Units
*Machine Tool Technology 60A (Machine Tool Technology I)	4
*Machine Tool Technology 60B (Machine Tool Technology II)	4
*Machine Tool Technology 60C (Machine Tool Technology III)	4
Machine Tool Technology 63A-B-C (Individual Projects)	6
Drafting Technology 50 (Mechanical Drawing)	2
Machine Tool Technology 71A-B (Tape Controlled Machining)	6
Welding Technology 70 (Introduction to Welding)	3
Industrial Technology 74 (Measurements and Calculations)	3
	32

Total units required - 32
(Certificate of Achievement)

* or equivalent

If further information is desired, contact the
ADMISSIONS AND RECORDS OFFICE
Chabot College
25555 Hesperian Boulevard
Hayward, California 94545
Telephone: 786-6700

BEST COPY AVAILABLE

A.A. DEGREE

MACHINE TOOL TECHNOLOGY

FRESHMAN YEAR	UNITS A	W	S
MACHINE TOOL TECHNOLOGY 60A (Machine Tool Technology I)	3		
MACHINE TOOL TECHNOLOGY 60B (Machine Tool Technology II)		3	
MACHINE TOOL TECHNOLOGY 60C (Machine Tool Technology III)			3
MACHINE TOOL TECHNOLOGY 71A-71B (Tape Controlled Machining)		3	3
DRAFTING 50 (Mechanical Drawing)	2		
INDUSTRIAL TECHNOLOGY 74 (Measurements and Calculations)			3
Physical Education I	½	½	½
English Composition-Speech			
Health Education			
*Electives			

SOPHOMORE YEAR	A	W	S
MACHINE TOOL TECHNOLOGY 65 (Production Machining Practices)	4		
MACHINE TOOL TECHNOLOGY 66 (Basic Die Making)		4	
MACHINE TOOL TECHNOLOGY 67 (Jigs and Fixtures)			4
WELDING TECHNOLOGY 70 (Introduction to Welding)		3	
ELECTRONICS TECHNOLOGY 70 (Basic Electricity)	2		
Physical Education I	½	½	½
American Institutions			
Natural Sciences			
Humanities			
Social Sciences			
*Electives			

FOR SPECIFIC GENERAL EDUCATION COURSES REFER TO SECTION ON GRADUATION REQUIREMENTS

---

*Suggested electives: Machine Tool Technology 63A-63B-63C; Machine Tool Technology 81A, 81B; Industrial Technology 78 (Shop Management); Work Experience 95 (Occupational Work Experience Education); Work Experience 96 (Occupational Work Experience Seminar); Tutorials.

Chabot College A.A. Degree (Total units required - 90)

CHABOT COLLEGE

MACHINE TOOL TECHNOLOGY

CERTIFICATE PROGRAMS

MACHINIST

	Autumn		Winter		Spring		SS	
1st Year	*MTT 60A	4	*MTT 60B	4	*MTT 60C	4	(IT 74)	(3)
	MTT 63A	2	MTT 63B	2	MTT 63C	2	(WELD 70)	(3)
	DRAFT 50	2	MTT 71A	3	MTT 71B	3		
	*MATH 50	(5)	WELD 70	3	IT 74	3		

*or equivalent

total units: 32

Standard load = 15
Minimum load = 12
Maximum load = 18

N/C PROGRAMMER

	Autumn		Winter		Spring		SS	
1st Year	*MTT 60A	4	*MTT 60B	4	*MTT 60C	4	(IT 74)	(3)
	*MATH 50	(5)	MTT 71A	3	MTT 71B	3	(WELD 70)	(3)
	**MTT 63A	(2)	**MTT 63B	2	IT 74	3		
	DRAFT 50	2			**MTT 63C	2		
2nd Year	MTT 65	4	MTT 66	4	MTT 67	4		
	**MATH 51	(5)	MTT 81A	3	MTT 81B	3		
			**MATH 52	(5)	**MATH 21	(5)		

* or equivalent

total units: 41

** strongly recommended

New Courses: MTT 81A, 81B - APT N/C Programming
IT 74 - Measurements & Calculations

TOOL MAKER

	Autumn		Winter		Spring		SS	
1st Year	*MTT 60A	4	*MTT 60B	4	* MTT 60C	4	(IT 74)	(3)
	DRAFT 50	2	WELD 70	3	IT 74	3	(WELD 70)	(3)
	*MATH 50	(5)	**MATH 51	(5)	** MATH 52	(5)		

2nd Year	MTT 65	4	MTT 66	4	MTT 67	4		
	**MTT 63A	(2)	MTT 71A	3	MTT 71B	3		
	**MATH 21	(5)	**MTT 63B	(2)	**MTT 63C	(2)		

*or equivalent

**recommended

total units: 38

37

Chabot College

Course Outline for Machine Tool Technology 60A
Machine Tool Technology I

Catalog Description:

60A - Machine Tool Technology I 4 units

A basic course in Machine Shop Practice, Theory and laboratory practice in precision measurement, layout and benchwork, screw threads, drill presses, band saw operations, basic lathe operations, and examination of job opportunities. Safe and correct use of hand and machine tools is stressed. 2 hours lecture, 6 hour laboratory.

Expected Outcomes for Students:

1. Student will be able to properly use precision measuring tools such as the dial test indicator, vernier caliper, vernier height gage, and various types of micrometers.
2. Student will be able to perform common bench operations such as filing, sawing, and hand threading operations.
3. Students will be able to properly set up and perform basic drill press, band saw, and basic lathe operations.
4. Student will be able to make precision layouts on the surface plate using precision layout tools such as the angle plate, surface gage, parallels, precision square, vernier height gage, and sine bar.
5. Student will be able to apply basic mathematics for calculating formulae relating to speeds, feeds, and layout operations.

Course Content:

1. Measuring tools
2. Bench Work
3. Layout Methods
4. Screw Threads
5. Drill Press Operations
6. Band Saw Operations
7. Basic Lathe Operations
8. Job Opportunities

Methods of Presentation:

Lecturing, laboratory projects, demonstrations, visual aids, and field trips.

Method of Evaluating Student Progress:

Evaluation is on the basis of ability to use good shop practices and mechanical judgment, quality and quantity of laboratory work, homework assignments, short quizzes and tests, one mid-term examination and one final examination.

Minimum Student Materials:

One pair of safety glasses, one shop coat, one padlock with two keys, 6" flex rule, set of Allen wrenches, and one 3/8 inch square high speed tool bit.

10/20/78 rg

Chabot College

Course Outline for Machine Tool Technology 60B
Machine Tool Technology II

Catalog Description:

60B - Machine Tool Technology II 4 units

Continuation of Machine Tool Technology 60A. Theory and laboratory practice relating to advanced lathe operations, basic vertical and horizontal milling machine operations, basic heat treating, job planning, and application of related formulae. Correct setup of machine tools and quality of work is stressed. Prerequisite: Machine Tool Technology 60A, Mathematics 50* (may be taken concurrently) 2 hours lecture, 6 hours laboratory.

Expected Outcome for Students

1. Student will be able to set up and perform advanced lathe operations such as taper turning, boring, internal threading, and form tool operations.
2. Student will be able to set up and do basic milling operations.
3. Student will be able to apply related mathematical formulae.
4. Student will be able to work to plus or minus .001 tolerances.
5. Student will be able to use precision measuring tools such as the thread, depth, and inside micrometers, optical comparator, and sine bar.
6. Student will be able to perform basic heat treat operations and test hardness of tool steels.

Course Content:

1. Lathe Operations
2. Basic Milling Machine Operations
3. Basic heat treating.

Methods of Presentation:

Lecturing, lab projects, demonstrations, visual aids, and field trips.

Method of Evaluating Student Progress:

Evaluation is on the basis of ability to use good shop practices, mechanical judgment, quality and quantity of work, homework assignments, quizzes and tests, and midterm and final examinations.

Minimum Student Materials:

One pair of safety glasses, one shop coat, one padlock with two keys, 6" flexible rule, set of Allen Wrenches and one 3/8" square tool bit.

* or equivalent

10/20/78 rg

Chabot College

Course Outline for Machine Tool Technology 60C
Machine Tool Technology III

Catalog Description:

60C - Machine Tool Technology III 4 units

Continuation of Machine Tool Technology 60B. Theory and laboratory practice relating to advanced milling machine operations, gear cutting, basic surface and cylindrical grinding, and metric measurement. Correct machine tool setups and quality of work is stressed. Prerequisites: Machine Tool Technology 60B, Drafting Technology 50*. 2 hours lecture, 6 hours laboratory.

Expected Outcomes for Students:

1. Student will be able to apply mathematical formulas relating to milling speeds and feeds, indexing operations, boring and gearing.
2. Student will be able to set up and use basic milling machine attachments and perform milling operations such as indexing, rotary table operations, precision boring, and gear cutting.
3. Student will be able to perform basic surface grinding and cylindrical grinding operations.
4. Student will be able to convert English measurements to metric and use metric micrometers and vernier measuring instruments.

Course Content:

1. Milling Operations
   a. Milling Attachments
   b. Indexing Operations
   c. Rotary Table Operations
   d. Boring Operations
   e. Cutting a Spur Gear
2. Grinding Operations
   a. Surface Grinding
   b. Cylindrical Grinding
3. Metrics
   a. Conversion of Inch to Metric
   b. Metric micrometers and vernier calipers.

Methods of Presentation:

Lecturing, lab projects, demonstrations, visual aids, and field trips.

Method of Evaluating Student Progress:

Evaluation is on the basis of ability to use good shop practices, mechanical judgment, quality and quantity of work, homework assignments, quizzes and tests, and midterm and final examinations.

Minimum Student Materials:

One pair of safety glasses, one shop coat, one padlock with two keys, 6" flexible rule, set of Allen wrenches and one 3/8" square tool bit.

*or equivalent

10/20/78 rg

Chabot College

Course Outline for Machine Tool Technology 71A
Tape Controlled Machining

Catalog Description:

71A - Tape Controlled Machining 3 units

A basic course in programming and operating 2 axis tape controlled machine tools. Areas of instruction include: Rectangular coordinates, quadrants, machine axis designation, absolute and incremental positioning, the binary code, control media, EIA coding and tape preparation, and machine tool tryout of 2 axis drill, mill, and rotary table programs. 2½ hours lecture, 1½ hours laboratory.

Expected Outcomes for Students:

This course provides basic instruction in tape controlled machining so the student will be able to:

1. Understand the basic concepts of 2 axis tape controlled machine tools.
2. Prepare basic 2 axis numerical control manuscripts.
3. Program and run basic drill and mill programs for 2 axis tape controlled machine tools.
4. Program and run basic rotary table programs.

Course Content:

1. Introduction
2. Rectangular Coordinates
3. Quadrants
4. Machine Axis Designation
5. Absolute and Incremental Positioning
6. The Binary Code
7. Control Media
8. EIA Coding
9. Drill Programs
10. Mill Programs
11. Rotary Table Programs

Methods of Presentation:

Instruction will include lecturing, machine demonstrations, machine set-up, visual aids, and field trips.

Methods of Evaluating Student Progress:

Student progress will be evaluated on the basis of homework assignments, classroom and laboratory exercises, short quizzes, project drawings, one mid-term examination and one final examination. Grading will be evaluated as follows: Quizzes 20%, homework 20%, machine operation 30%, and tests 30%.

Minimum Student Materials:

None

10/20/78 rg

Chabot College

Course Outline for Machine Tool Technology 71B
Tape Controlled Machining

Catalog Description:

71B - Tape Controlled Machining 3 units

Continuation of Machine Tool Technology 71A. Instruction includes programming, tape preparation, editing, and machine tool operation of 3 axis CNC milling, drilling, and boring machines. Program use of linear axis, arc center offset, feedrate, spindle speed, and tool select commands are included as well as preparatory functions, miscellaneous functions, and repetitive type programming. Prerequisite: Machine Tool Technology 71A. 2-1/2 hours lecture, 1-1/2 hours laboratory.

Expected Outcomes for Students:

The student will be able to:
1. Understand the basic concepts of 3 axis tape controlled machine tools.
2. Program and run basic 3 axis part programs.
3. Calculate correct cutting tool speeds and feeds.
4. Use a terminal to edit and change a program.
5. Understand and use the MDI keyboard on the machine tool.
6. Use standard machine tool codes and functions.

Course Content:

1. Features of the Bridgeport Series I CNC Milling Machine.
2. Optional Equipment.
3. Program Format.
4. The Coordinate Systems.
5. Program Entries
   a. Definition block and block delete
   b. Sequence number
   c. Preparatory functions
   d. Linear axis commands
   e. Arc center offset
   f. Feedrate commands
   g. Spindle speed command
   h. Tool select commands
   i. Miscellaneous function commands
   j. End of block command
6. Repetitive Programming.

Methods of Presentation:

Instruction will include lecturing, machine demonstration, machine set-up, visual aids, and field trips.

Methods of Evaluating Student Progress:

Student progress will be evaluated on the basis of homework assignments, classroom and laboratory exercises, short quizzes, project drawings, one mid-term examination and one final examination. Grading will be evaluated as follows: Quizzes 20%, homework 20%, Machine Operation 30%, and tests 30%.

Minimum Student Materials:

None

10/20/78 rg.

Chabot College

Course Outline for Drafting Technology 50
Mechanical Drawing

Catalog Description:

50 - Mechanical Drawing 2 units

Principles and practice of mechanical drawing, introduction to orthographic projection, lettering and isometric drawing. 6 hours laboratory.

Expected Outcomes for Students:

1. The student will become proficient in the use of a pencil; be able to letter legibly; to produce sharp black pencil lines demanded today by industry, to simulate ink drawings.
2. The student will be trained in the use of various drafting equipment, be able to read and use scales.
3. Furthermore, he will be able to select proper object views, take off dimensions, reproduce an exact object drawing to scale, with views placed properly on drafting vellum to produce a complete, accurate working drawing.

Methods of Presentation:

This will be by lecture, black board demonstration, individual tutoring, or group tutoring, at various times during the 3 hour laboratory period.

Evaluation of Student Progress:

Students will be evaluated by satisfactory completion of pre-assigned problem plates, two spaced tests, and a final.

Minimum Student Materials:

1. Technical Drawing textbook.
2. Problem plate work book.
3. Drafting equipment as outlined in furnished materials list.

Revised: 2/16/78
vy

CHABOT COLLEGE

COURSE OUTLINE FOR INDUSTRIAL TECHNOLOGY 74
Measurements and Calculations

Catalog Description:

74 - Measurements and Calculations 3 units

Practical applications of mathematical skills. All units of instruction will have one or more application exercises coordinated with and for use in the various industrial technology disciplines. Prerequisite: Mathematics 50*. 3 hours.

Expected Outcomes for Students:

1. The student will be able to apply his mathematical knowledge to practical shop situations.
2. To provide the student with the necessary experiences in performing calculations related to the field of Industrial Technology.

Course Content:

1. Blueprint reading and mathematics.
2. Understanding charts, tables and reference materials.
3. Metric systems/conversions.
4. Calculations and applications of mathematical skills. Using calculator.

Methods of Presentation:

Lecture, discussion and problem solving.

Methods of Evaluating Student Progress:

Classwork, examinations, quizzes, homework and a two-hour final.

Minimum Student Materials:

An Algebraic slide rule-type calculator, a notebook and the required text.

*Or equivalent.

6-9-78 jg

Chabot College

Course Outline for Machine Tool Technology 65
Production Machining Practices

Catalog Description:

65 - Production Machining Practices 4 units

An advanced course in production machining practices as applied in industry today. Production tools such as jigs and fixtures are used on conventional and numerically controlled machine tools to manufacture class projects. Correct speeds and feeds, use of carbide tooling, and proper inspection techniques are stressed. Prerequisite: Machine Tool Technology 60C. 2 hours lecture, 6 hours laboratory.

Expected Outcomes for Students

1. Student will be able to compute correct speeds and feeds for various types of carbide and high speed cutting tools and materials.
2. Student will be able to set up jigs and fixtures on standard and numerically controlled machine tools to perform basic production machining operations.
3. Student will acquire hands on skills relating to production processes and machining techniques.
4. Student will know how to inspect production parts.

Course Content

1. Basic function of production tooling
2. Design features of production tooling
3. Setting up production tools (jigs and fixtures)
4. Machine tool requirements
5. Selecting correct speeds and feeds
6. Running production parts
7. Part inspection
8. Machine tool maintenance

Methods of Presentation

Instruction will include lecturing, laboratory projects, demonstrations, visual aids and field trips.

Methods of Evaluating Student Progress

Student progress will be evaluated on the basis of ability to use good mechanical judgment, quality and quantity of laboratory work, homework assignment, short quizzes and tests, one mid-term examination and one final examination. Grading will be evaluated as follows: Follow instructions 10%, homework assignments 20%, tests and quizzes 30%, and laboratory projects 40%.

Minimum Student Materials

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys or combination lock, 6" flexible steel rule, one set of Allen wrenches, and one 3/8" square tool bit.

Chabot College

Course Outline for Machine Tool Technology 66
Jigs and Fixtures

Catalog Desciption

66 - Jigs and Fixtures 4 units

An advanced course offering theory and laboratory practice in the design and fabrication of production type jigs and fixtures. Correct tool design and fabrication procedures relating to production tooling is stressed. Prerequisite: Machine Tool Technology 60C. 2 hours lecture, 6 hours laboratory.

Expected Outcomes for Students

1. The student will know the basic principles of tool design.
2. The student will be able to design and fabricate simple production tools.
3. The student will be able to set up and run basic production tools.
4. The student will know how to do precision jig boring.
5. The student will know how to heat treat tool steel.
6. The student will be able to do surface and cylindrical grinding.

Course Content

1. Jigs and Fixtures
   a. Introduction
   b. Types of Jigs and Fixtures
   c. Jig and Fixture Components
   d. Jig Bushings
   e. Jig Plate
   f. Set Blocks
   g. Basic Principles of Tool Design
   h. Principles of Jig Boring
   i. Heat Treating Tool Steel
   j. Grinding Practices

Methods of Presentation

Instruction will include lecturing, laboratory projects, demonstrations, visual aids, and field trips.

Method of Evaluating Student Progress

Student progress will be evaluated on the basis of ability to use good mechanical judgment, quality and quantity of laboratory work, homework assignments short quizzes and tests, one mid-term examination and one final examination. Grading will be evaluated as follows: Follow instructions 10%, homework assignments 20%, tests and quizzes 30%, and laboratory projects 40%.

Minimum Student Materials

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys, 6" flexible rule, set of Allen wrenches, and one 3/8" square tool bit.

Chabot College

Course Outline for Machine Tool Technology 67
Applied Machining Practices

Catalog Description:

67 - Applied Machining Practices 4 units

An advanced course designed to provide the student an opportunity to apply his Machine Tool training to develop a special project in one of several different areas to increase his job skills for employment. Specific areas of specialization include: Tool Making, Numerical Control Machining, Production Machining and Inspection Practices. Prerequisite: Machine Tool Technology 60C. 2 hours lecture, 6 hours laboratory.

Expected Outcomes for Students:

1. The student will be able to plan the sequence of operations required to manufacture his selected project.
2. The student will be able to make an acceptable project drawing.
3. The student will be able to estimate actual cost of materials for his project.
4. The student will be able to determine correct speeds, feeds, and tooling requirements for his project.
5. The student will be able to use acceptable machining practices.
6. The student will be able to apply metric measurement in his project development.

Course Content:

1. Determine area of specialization for each student.
2. Determine requirements for project.
3. Selection of a challenging project.
4. Planning the project.
5. Fabricating the project.
6. Inspecting the project
7. The student's project report.

Methods of Presentation:

Instruction will include lecturing, individual projects, demonstrations, and visual aids.

Method of Evaluating Student Progress

Student progress will be determined on the basis of quality and quantity of laboratory work, ability to use good mechanical judgment, progress reports, homework assignments, quizzes, one mid-term and one final examination. Grading will be evaluated as follows: Tests and quizzes 25%, student project report 25%, and laboratory project 50%.

Minimum Student Materials:

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys, 6" flexible rule, set of Allen wrenches, and one 3/8" square tool bit.

10/20/78 rg

Chabot College

October 2, 1978

Course Outline for Welding Technology 70
Introduction to Welding

Catalog Description

3 units

70-Introduction to Welding
Oxyacetylene processes, stick electrode, tungsten inert gas, and semiautomatic welding; carbon-arc metal removal and flame gouging. Theory and care of welder's equipment with emphasis on safety practices. 1 hour lecture, 6 hours laboratory.

Expected Outcomes for Students:

The student will be able to:

1. Safely handle and properly care for oxyacetylene equipment, arc welding equipment, semi-automatic welding equipment and general shop tools.
2. Name and define career potentials in the welding industry.
3. Gas weld sheet metal in flat and vertical positions.
4. Arc weld steel joints in flat and horizontal positions.
5. TIG weld aluminum joints in flat position.
6. Make a simple braze weld.
7. Flame cut manually and with a machine.
8. Remove metal with the arc-air process.

Course Content:

1. The oxyacetylene welding process.
2. The arc welding process.
3. The flame cutting process.
4. Careers in Welding.
5. Basic metallurgy.

Methods of Presentation:

One hour lecture and two three-hour labs per week. Models, movies, slides, charts, demonstrations, field trips and library references will be used.

Evaluation of Student Progress

Student progress will be evaluated by completed assignments, reports, research, laboratory work, quizzes and examinations.

Required Student Materials

Safety glasses and either a shop coat, apron or welder's jacket.

10/2/78 ew

Course Outline for Electronics 70
Basic Electricity

Catalog Description: 2 UNITS

70 - Basic Electricity

Fundamentals of electricity for non-majors; Ohm's Law, basic units, magnetism, direct and alternating current, motors, generators, meters. Prerequisite: Mathematics 50 (may be taken concurrently). Not open to students taking or who have completed Electronics-Mechanics 60A. 1 hour lecture, 3 hours laboratory.

Expected Outcomes for Students:

The student will gain an understanding of electrical principles and will be able to make basic calculations and read schematics.

Course Content:

I. Ohms Law
II. Series circuits
III. Parallel circuits
IV. Voltage sources
V. Motors
VI. Generators

Methods of Presentation:

Use of lectures and demonstrations, visual aids, overhead and problem solving, also lab experiments weekly.

Methods of Evaluation:

Quizzes, tests, problems - 50%, lab experiments - 50%.

Minimum Student Materials:

None other than texts.

Chabot College

Course Outline for Machine Tool Technology 63A
Individual Projects

Catalog Description:

63A - Individual Projects 2 units

Open only to Machine Tool Technology and Machine Shop majors. Development, design and fabrication of individual projects to develop occupational entry skills. Prerequisite: Concurrent enrollment in Machine Tool Technology 60A. 6 hours laboratory.

Expected Outcomes for Students:

The student will be able to set up and perform basic operations on the following machine shop equipment:

a. The Drill Press
b. The Band Saw
c. The Lathe
d. The Vertical Milling Machine

Course Content:

1. This is a laboratory course only. Students are assigned selected projects to develop occupational entry skills.

Methods of Presentation:

Instruction will include laboratory projects, demonstrations, and field trips.

Method of Evaluating Student Progress:

Student progress will be evaluated on the basis of ability to use good mechanical judgment, quality and quantity of laboratory work, homework assignments, short quizzes and tests, one mid-term examination and one final examination. Grading will be evaluated as follows: Follow instructions 10%, homework assignments 20%, tests and quizzes 30%, and laboratory projects 40%.

Minimum Student Materials:

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys, 6" flexible rule, set of Allen wrenches, and one 3/8" square tool bit.

10/28/78 rg

Chabot College

Course Outline for Machine Tool Technology 63B
Individual Projects

Catalog Description:

63B - Individual Projects 2 units

Continuation of Machine Tool Technology 63A. Prerequisite: Concurrent enrollment in Machine Tool Technology 60B. 6 hours laboratory.

Expected Outcomes for Students:

The student will be able to set up and perform basic operations on the following machine shop equipment:

a. The Drill Press
b. The Band Saw
c. The Lathe
d. The Vertical Milling Machine
e. The Horizontal Milling Machine

Course Content:

1. This is a laboratory course only. Students are assigned selected projects to develop occupational entry skills.

Methods of Presentation:

Instruction will include laboratory projects, demonstrations, and field trips.

Method of Evaluating Student Progress:

Student progress will be evaluated on the basis of ability to use good mechanical judgment, quality and quantity of laboratory work, homework assignments, short quizzes and tests, one mid-term examination and one final examination. Grading will be evaluated as follows: Follow instructions 10%, homework assignments 20%, tests and quizzes 30%, and laboratory projects 40%.

Minimum Student Materials:

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys, 6" flexible rule, set of Allen wrenches, and one 3/8" square tool bit.

10/20/78 rg

Chabot College

Course Outline for Machine Tool Technology 63C
Individual Projects

CATALOG DESCRIPTION

63C - Individual Projects 2 units

Continuation of Machine Tool Technology 63B. Prerequisite: Concurrent enrollment in Machine Tool Technology 60C. 6 hours laboratory.

Expected Outcomes for Students

The student will be able to set up and perform basic operations on the following machine shop equipment:

a. The Drill Press
b. The Band Saw
c. The Lathe
d. The Vertical Milling Machine
e. The Horizontal Milling Machine

Course Content

1. This is a laboratory course only. Students are assigned selected projects to develop occupational entry skills.

Methods of Presentation

Instruction will include laboratory projects, demonstrations, and field trips.

Method of Evaluating Student Progress

Student progress will be evaluated on the basis of ability to use good mechanical judgment, quality and quantity of laboratory work, homework assignments, short quizzes and tests, one mid-term examination and one final examination. Grading will be evaluated as follows: Follow instructions 10%, homework assignments 20%, tests and quizzes 30%, and laboratory projects 40%.

Minimum Student Materials

The student will be required to purchase one pair of safety glasses, one shop coat, padlock with two keys, 6" flexible rule, set of Allen wrenches, and one 3/8" square tool bit.

10/20/78. rg

Chabot College

Course Outline for Machine Tool Technology 81A
Numerical Control APT Part Programming

Catalog Description

81A - Numerical Control APT Part Programming 3 units

Introduction to fundamentals of APT Part Programming for numerical control machine tools. This course will offer the theory and laboratory practice for writing APT computer assisted part programs, processing and debugging the programs on the computer system, proving how the programs work on a graphical terminal and numerical control machine tool. Prerequisites: Machine Tool Technology 71B*. 2½ hours lecture. 1½ hours laboratory.

Expected Outcome for Students

This course will provide basic instruction in the fundamental concepts of APT Computer assisted part programming so that the student will:

a. Understand the syntactical structure of the APT language.
b. Be able to write APT Part Programming which includes defining part geometry, continuous path motion instruction, and writing machine post processor commands.
c. Be able to use and understand the computer as a tool for processing and debugging APT Part Programs to obtain a punched tape for driving numerical control machine tools.

Course Content

1. APT Length Syntax
2. Arithmetic operators and function.
3. Basic geometry.
4. Motion instructions.
5. Post processor commanding.
6. Computer terminal operation.
7. Computer time share editing.
8. Diagnostic analysis.

Methods of Presentation

Lecturing, laboratory projects, demonstration, visual aids and field trips.

Methods of Evaluation

Student progress will be evaluated on the basis of homework assignments, classroom and laboratory exercises, short quizzes, one mid-term examination, one final examination.

Classroom and laboratory exercises..... 20%
Homework assignments..... 30%
Tests and quizzes..... 50%

Minimum Student Material

APT Training Manual.
APT User Guide.
APT Time Share User Guide.

*Or equivalent.

Chabot College

Course Outline for Machine Tool Technology 81B
Advanced Numerical Control APT Part Programming

Catalog Description

81B - Advanced Numerical Control APT Part Programming 3 units

Continuation of 81A (Beginning Numerical Control APT Part Programming). This course will offer advanced theory and laboratory practice for writing APT computer assisted part programs. APT part programs will be processed and debugged on the computer system and tapes proved out on a graphics terminal and 3-axis numerical control machine tool.
Prerequisites: Numerical Control APT Part Programming 81A*,
2½ hours lecture. 1½ hours laboratory.

Expected Outcomes for Students

This course will provide advanced instruction in the sophisticated concepts of APT computer assisted part programming so that the student will:

a. Understand the syntactical structure of advanced features in the APT language.
b. Be able to write APT part programs using geometry and cutter path transformations, and repetitive programming techniques.
c. Be able to use and understand the computer as a tool for processing and debugging APT part programs to obtain punched tape for driving numerical control machine tools.

Course Content

1. APT language syntax.
2. Three dimensional surfaces.
3. Geometry and cutter path transformation with matrix and tool axis.
4. Repetitive programming with Loops, Macro, and Copy.
5. Postprocessor commands.
6. Diagnostic Analysis.

Methods of Presentation

Lecture, laboratory projects, demonstration, visual aids, and field trips.

Methods of Evaluation

Student progress will be evaluated on the basis of homework assignments, classroom and laboratory exercises, short quizzes, one mid-term examination, one final examination.

Classroom and laboratory exercises 20%
Homework assignments 30%
Texts and quizzes 50%

Minimum Student Material:

APT Training Manual
APT User Guide
APT Time Share User Guide

*Or equivalent.

SAMPLE CLASS ASSIGNMENTS
AND TESTS

PREPARED BY: _____

MACHINE TOOL TECH _____ SECTION _____

DATE _____

BRIDGEPORT SERIES I CNC

PROGRAM SHEET

PART NO. _____

PART NAME _____

SHEET _____ OF _____

N	G	X/Y	X/Y/Z	Y/Z/I/J	Y/Z/J/K	F	S	T	M	NOTES

SAMPLE A

HURCO

MANUFACTURING CO. INC.

CNC MILLING PROGRAM SHEET

SHT. _____ OF _____

BY _____ DATE _____

PART NAME | DWG NO. | OPER. REV.

WORK HOLDING INSTRUCTIONS _____

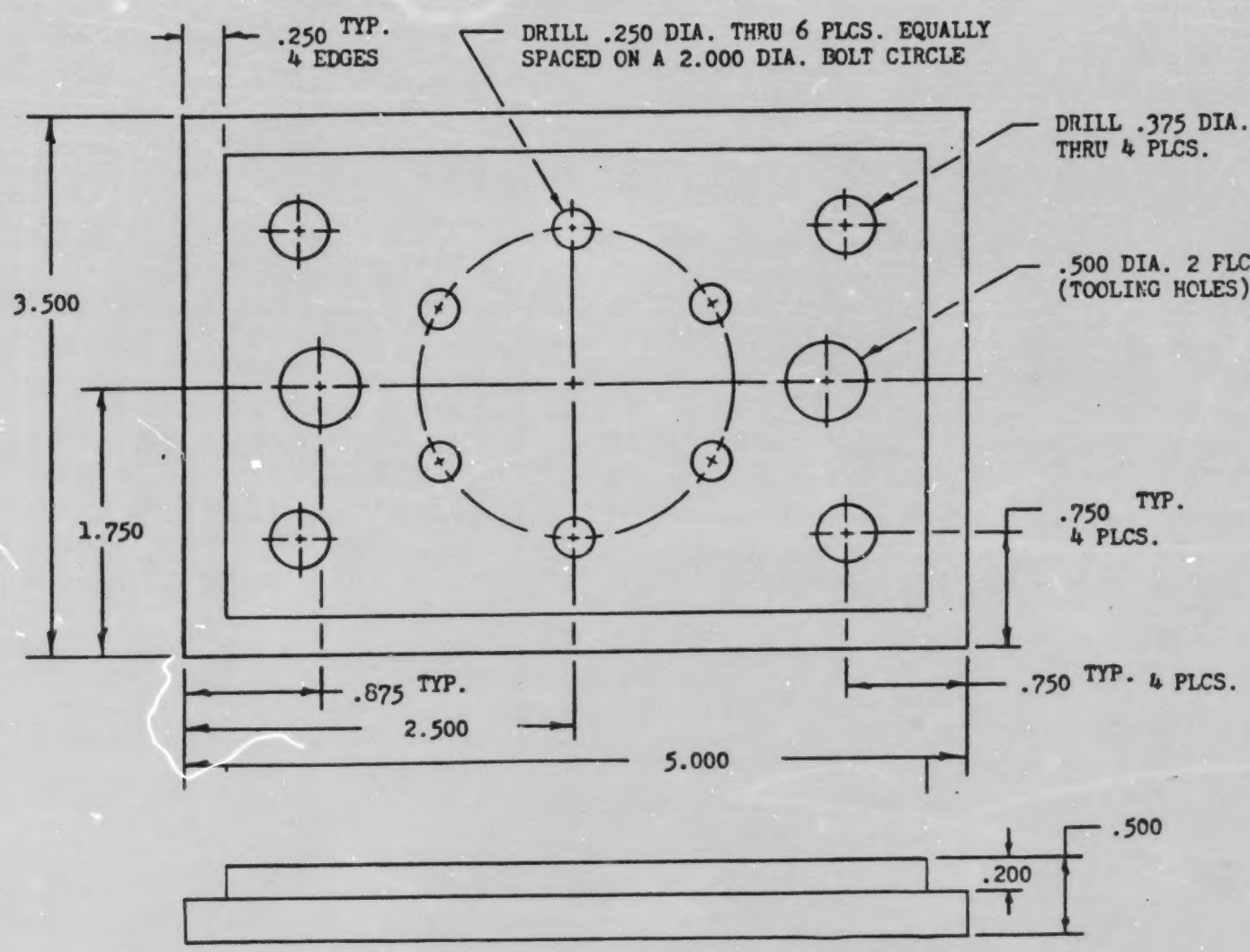
REFERENCING INSTRUCTIONS _____

DATA BLK. NO.	TYPE BLOCK 0 (STD) 1 LOOP 2 REP 3 STOP 4 COPY	TYPE OPER. 0 POS 1 DRILL 2 BORE 3 TAP 4 MILL	DRILLING OPTIONS 0 (STD) 1 BOLTCIR 2 CUT RT 3 CUT LT	MILLING OPTIONS 0 (STD) 1 Q CIR C 2 Q CIR CC 3 ARC C 4 ARC CC 5 CIRCLE 6 FRAME 7 CIR 2P 8 FRM 2P	 0 INSIDE 1 OUTSIDE 2 IN/TAN 3 OUT/TAN 4 POCKET	DIMENSIONS A-ABSOLUTE I-INCREMENTAL X	 Y	Z UP	Z DN	SUB-ROUTINE DATA HOLES	 ANGLE	 RADIUS	REPEAT NX	 NY	FEED RATE IPM	PECK RATE	TOOL NO.	SPINDLE SPEED	TOOL DESCRIPTION & REMARKS

CHABOT COLLEGE
MACHINE TECHNOLOGY 71B

INSTRUCTOR: (OLIVER
MT 71B-041070

PRT. NO. NC-41070

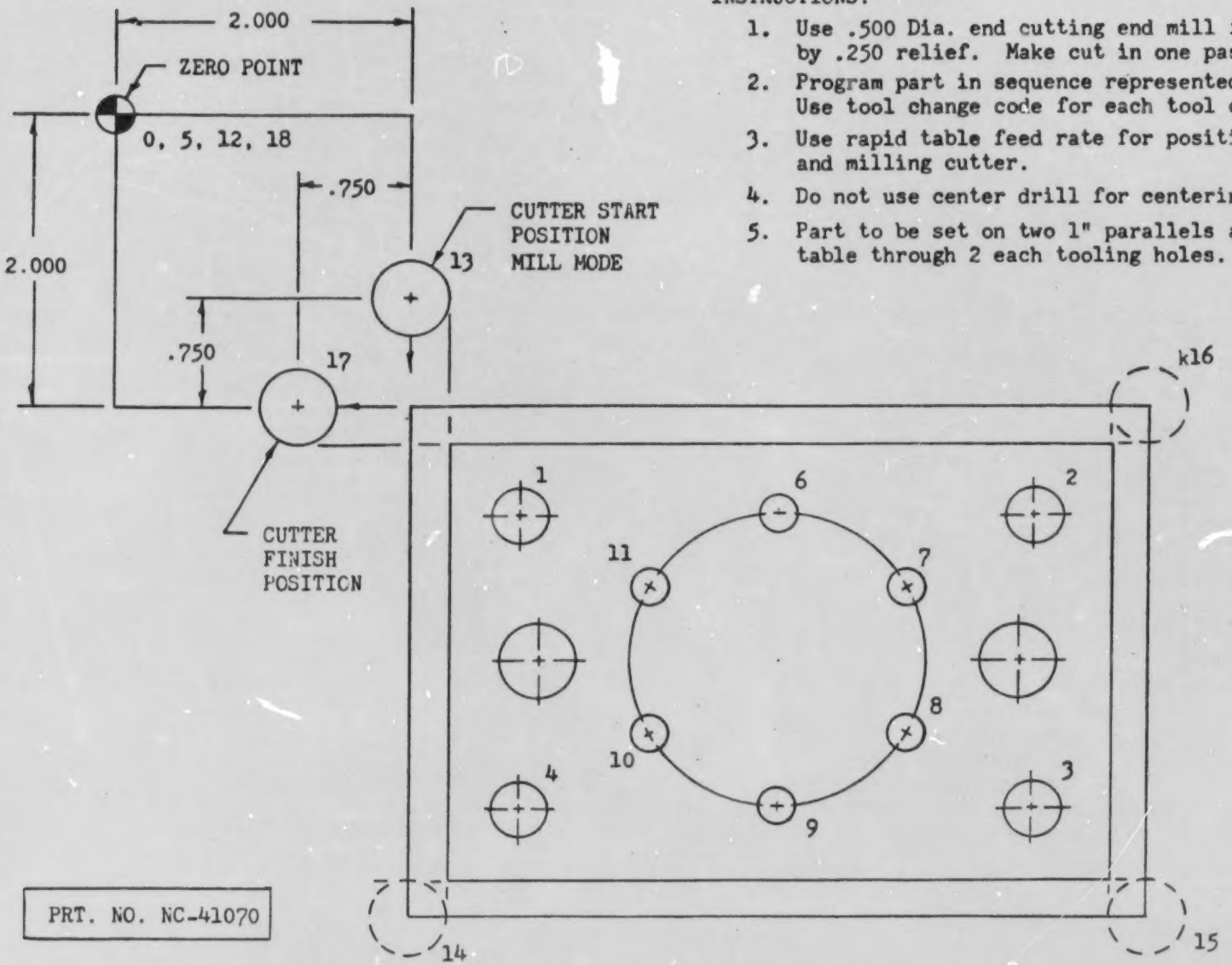


60

61

MATERIAL: 7075-T6 Aluminum

SAMPLE C



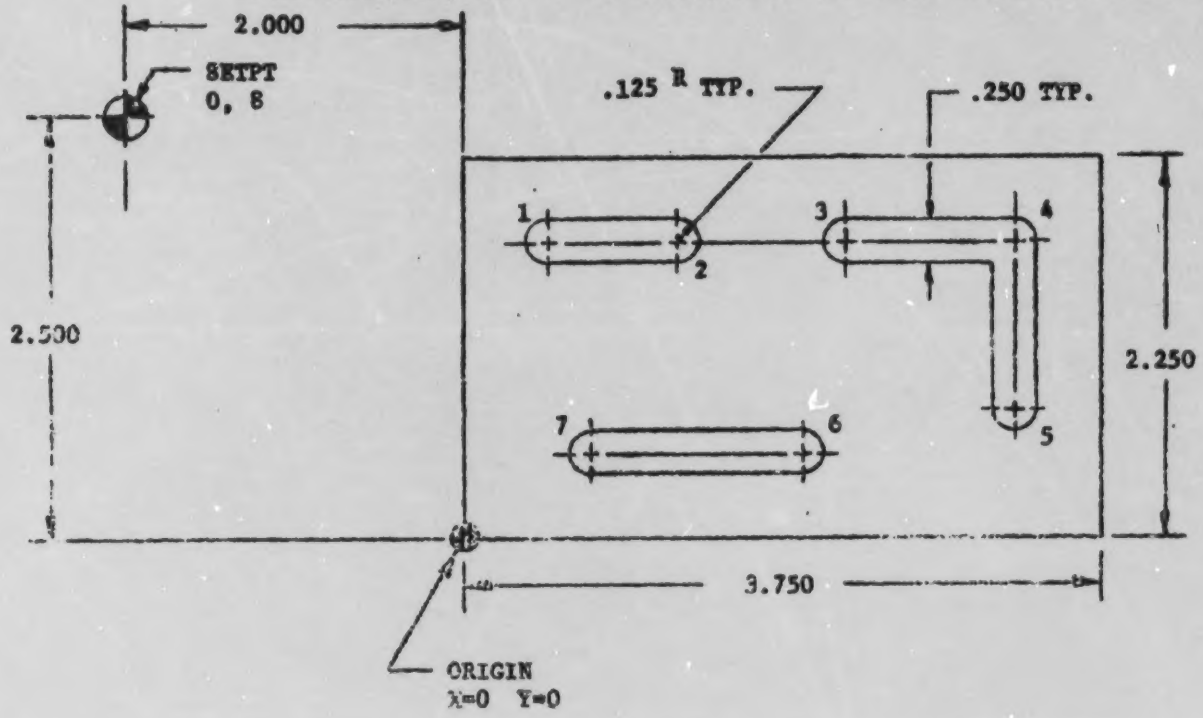
INSTRUCTIONS:

1. Use .500 Dia. end cutting end mill for milling .200 by .250 relief. Make cut in one pass.
2. Program part in sequence represented by numbers. Use tool change code for each tool change.
3. Use rapid table feed rate for positioning drills and milling cutter.
4. Do not use center drill for centering holes.
5. Part to be set on two 1" parallels and clamped to table through 2 each tooling holes.

PRT. NO. NC-41070

BRIDGEPORT CNC-1 MILL PROGRAM

INSTRUCTIONS: PROGRAM THE PART SHOWN BELOW FOR MILLING THE .250 WIDE SLOTS. TOOL LENGTH OFFSET TO BE 2.000 inches, FEED RATE TO BE 15 IPM FOR X AND Y MILLING AND 7.5 IPM FOR Z AXIS PLUNGING. ALL SLOTS TO BE .200 DEEP, AND "R" PLANE (RAPID TO POSITION) TO BE .050 ABOVE PART.



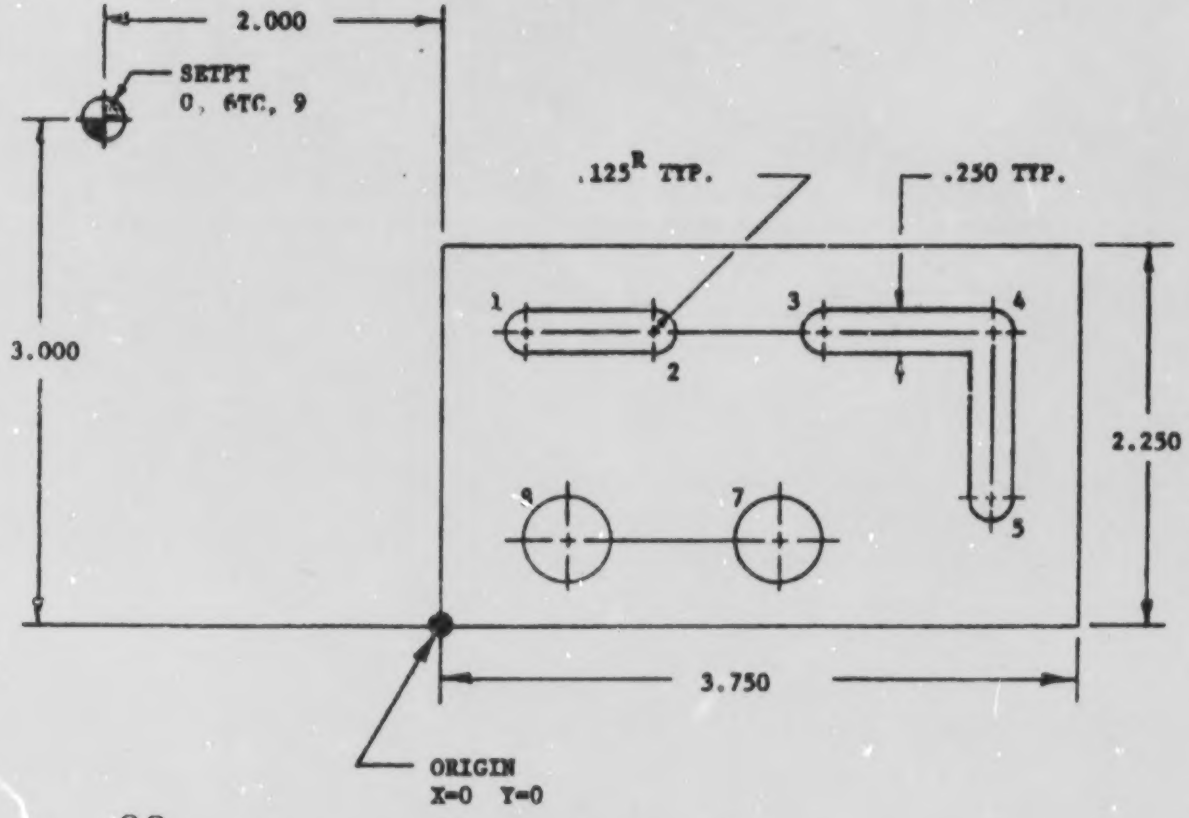
ABSOLUTE MILL COORDINATES		
LOC	X	Y
SETPT	-2.000	2.500
1	.500	1.750
2	1.250	1.750
3	2.250	1.750
4	3.250	1.750
5	3.250	.750
6	2.000	.500
7	.750	.500

CHABOT COLLEGE
TAPE CONTROLLED MACHINING 71B

INSTRUCTOR: C. OLIVER
MIT 71B-052379

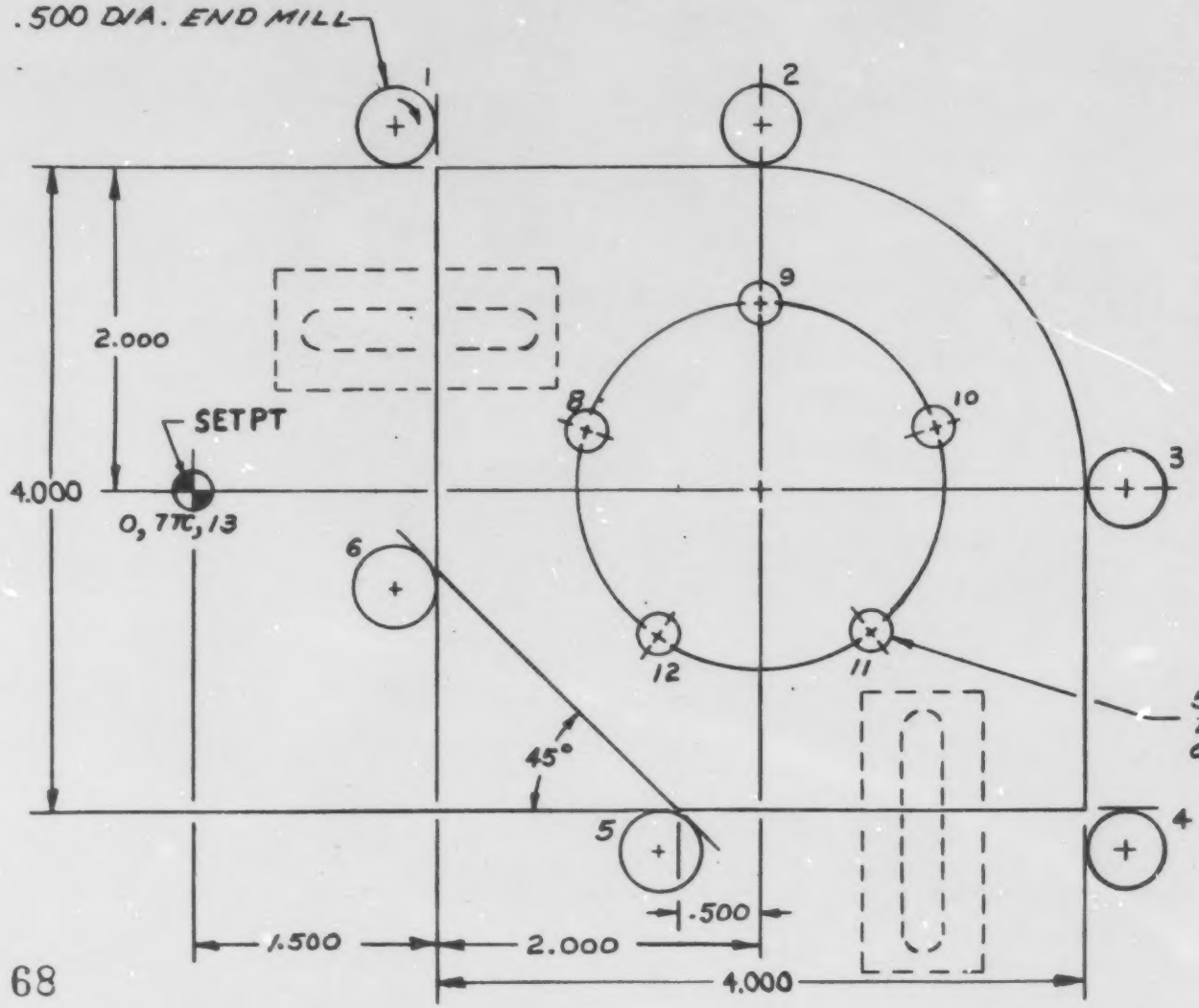
BRIDGEPORT CNC-1 DRILL & MILL PROGRAM

INSTRUCTIONS: PROGRAM THE PART SHOWN BELOW FOR DRILLING 2 EA. .500 DIAMETER HOLES AND MILLING THE .250 WIDE SLOTS. FEED RATE TO BE 5 IPM FOR DRILLING, 7.5 IPM FOR "Z" AXIS PLUNGING, AND 10 IPM FOR STRAIGHT MILLING. THE .250 WIDE SLOTS TO BE .150 DEEP AND THE .500 DIAMETER HOLES TO BE .750 DEEP. THE "R" PLANE (RAPID TO POSITION FOR "Z") TO BE .050 ABOVE THE PART.



ABSOLUTE CUTTER COORDINATES		
LOC	X	Y
SETPT	-2.000	3.000
1	.500	1.750
2	1.250	1.750
3	2.250	1.750
4	3.250	1.750
5	3.250	.750
7	2.000	.500
8	.750	.500
9	-2.000	3.000

ROTARY TABLE PROGRAM



ABSOLUTE CUTTER COORDINATES

NO.	X	Y
1	.	.
2	.	.
3	.	.
4	.	.
5	.	.
6	.	.

ABSOLUTE HOLE COORDINATES

NO.	X	Y
8	.	.
9	.	.
10	.	.
11	.	.
12	.	.

NAME	SECTION

CHABOT COLLEGE

981A - APT Programming - Meeting 1

I. Introduction

A. Saturday services handout - break
B. Myself
C. Class description handouts.
1. What is APT - Simplified Programming
2. Prerequisite - None?
a. Machine shop 60A,B or equivalent
b. Manual programming 71A,B or equivalent
c. Reasons - shop oriented language, tap, bore, drill, ream, c'sink
d. Exceptions - engineers, industrial studies & technology, majors, women.
3. Description
4. Outcome
5. Content
6. Student materials
a. Buy - $25.00
b. Use and replace

D. Class Description
1. Reading - open book & examples
2. Organizing & logic
3. Math - limited
a. Basic algebra
b. Shop trig
4. Types of statements - definition, motion, computing, postprocessor
E. Class Goals - Entry level APT computer assist programmer
F. What it means to you:
1. Career - B/P to chips
2. Pay
3. Security & Demand
4. Stepping Stone:
a. N/C Coordinator
b. Services
c. Sales
G. Lab - partners - time

II. Take Roll
A. Petitions 1-n
B. Adds n-1

III. Student Questionnaire

IV. Manuals - Handout
A. APT Programming Manual
1. Relocate index
2. Relocate section 10
B. APT tests & exercises
C. Postprocessor UG
D. Fasbac UG

cont'd. ...

V. Computer Systems
   A. Batch - 1108
   B. Timesharing - FASBAC

VI. Reading
   A. Section 1 - all
   B. Section 2, 2-1 thru 2-2, look over 2-3 through 2-7
   C. Test

VII. Sample Program - Lab - Handout B/P

   A. Preliminaries
      1. Tool list
      2. Tool sequence
   B. Write Program
      1. Define Geometry
      2. Motion Instructions
      3. Postprocessor Commands
   C. Process Program

```
@ RUN, D CHABØT, LJM000, S60, 100
@ APT XQT
PARTNØ SAMPLE MILL-DRILL PROGRAM
MACHIN/BP003,2
CLPRNT; PRINT/SMALL
SAFETY/-15, -7, -5
PI=PØINT/.5,.375
PZ=PØINT/2.5,.375
HP=PØINT/.5,5,0
TC=PØINT/-5,.5,0
HLI=LINE/0,.375,1,.375
HLZ=LINE/0,1.5,1,1.5
TLI=LINE/PI,ATANGL,60
TLZ=LINE/PZ,ATANGL,120
CRI=CIRCLE/XLARGE,TLI,YSMALL,HLZ,XSMALL,TLZ
CRZ=CIRCLE/1.5,.937,.375
PLI=PLANE/0,0,1,-.625
PAT 1=PATERN/ARC,CRZ,0,300,CLW,6
PRINT/3,ALL
$$ SETUP PØINT IS UPPER LEFT HAND CORNER.
$$ Z zero is 1.000 ABØVE PART BASE.
$$ ØRIGIN IS LØWER LEFT CØRNER 1.000 ABØVE PART BASE.
SEQNØ/0,INCR,10,1
SET/START,0,Z,0
$$ MILL TRIANGLE PERIMETER WITH 1½ DIA END MILL
SELCTL/1
SPINDL/800,CLW
CØØLNT/FLØØD
FEDRAT/16,IPM
CUTTER/1.5
```

VII. C (cont'd.)

```
RAPID GØTØ/-1.6,-.5,-.625
SLØWDN/ØN
GØ/TØ,TLI,TØ,PLI,TØ,HLI
GØLFT/TLI,TANTØ,CRI
GØFWD/CRI,TANTØ,TLZ
GØFWD/TLZ,PAST,HLI
GØRGT/HLI,PAST,TLI
SLØWDN/ØFF
RAPID,GØTØ/TC
$$ CENTER DRILL (6) HOLES
SELCTL/Z
SPINDL/4000,CLW
CYCLE/DRILL,.05,6,IPM,-.4
GØTØ/PAT 1
CYCLE/ØFF
RAPID,GØTØ/TC
$$DRILL (6) 1/8 HOLES THRU
SELCTL/3
SPINDL/4000,CLW
CYCLE/DRILL,.65,8,IPM,.4
GOTØ/PAT 1
CYCLE/ØFF
RAPID, GØTØ/HP
CØØLNT/ØFF
END
FINI
@ BP003 XQT
```

CHABOT COLLEGE

981 - LAB - Meeting 2

I. Upper-Lower Case Test

II. Build START and FINISH Files

III. Type Source Tape

IV. Review Cook Book Procedure

V. Sample Run

VI. Review APT/FASBAC Differences

APT PROGRAMMING

I. Announcements - White Sheet

II. Take Roll - Adds

III. Review Sections 1 & 2 (Preliminaries)

IV. Take Test

V. Review Section 3 (points)

VI. Exercise - Formal and informal

VII. Review Section 4 (Point-to-point), pages 4-1 & 4-2.

VIII. Look over LINES & CIRCLES and work on exercises.

CHABOT COLLEGE

981 - APT Programming - Meeting 3

I. Lab
   A. Theory - data
   B. Commands - Manual
      1. Format
      *2. ØLD
      *3. NEW
      **4. TØP
      *5. ØPEN
      *6. SAVE
      **7. TØ & CHANGE
      **8. ADD
      **9. SPLIT
      **10. MØVE
      **11. CØPY
      **12. DELETE - both
      *13. UNSAVE
      **14. INSERT - both
      *15. BUILD
      *16. TAPE

   C. Finish Punching Sample
   D. Hand out updated procedure.

II. Lecture
   A. Announcements
      1. Formal - White Sheets
      2. Informal - Graphic capabilities
         a. Design - Modeling - Drafting - H/C
         b. APT source or CL files
         c. Postprocessors
   B. Roll
   C. Review - Syntax
   D. Point Transparencies
   E. Exercises - Book & Board
   F. Lines Transparencies
   G. Line Exercises
   H. Circle Transparencies
   I. Circle Exercises
   J. GØTØ/
   K. Postprocessor Commands

III. Homework
   A. Exercises
   B. Postprocessor Manual.

CHABOT COLLEGE

981 - APT Programming - Meeting 4

I. Lab
   A. On-Line (lecture) (Terminal Switches)
      1. Pairs
      2. Only (4) Terminals
      3. Cost - Learning
   B. Continue Punching Tape
   C. On-line editing
   D. Execute (1)
   E. Debug
   F. Review FASBAC manual - keep separate

II. Lecture
   A. Announcements
      1. Formal - white sheets
      2. Informal
   B. Review
      1. Points
      2. Lines - exercise (transparency)
   C. Circles - Transparencies
      1. Exercise
   D. GØTØ/ - Transparencies
   E. Postprocessor Commands
   F. Sections I-IV.
   G. Sample Program
   H. Homework - Sample Part - Pattern.

CHABOT COLLEGE

981 - APT Programming - Meeting 5

I. Lab
   A. Continue Editing
   B. Put errors into BP003 & Run
   C. Error Diagnostics

II. Lecture
   A. Announcements
      1. Formal - White Sheets
      2. Informal
   B. Review
      1. Circles
      2. Point-to-Point
   C. Postprocessor - manual (look over)
   D. Review sample program exercise
   E. Sections
   F. Vectors
   G. Patterns
   H. Homework - Sample Part (similar to mid-term).

CHABOT COLLEGE

981 - APT Programming - Meeting 6

I. Lab
   A. Editing exercise
   B. Punch homework part
   C. Process

II. Lecture
   A. Announcements
      1. Formal - white sheet
      2. Informal
   B. Take Roll
   C. Review Circles
   D. Vectors - transparencies
   E. Pattern - transparencies
   F. Pattern Exercise - Transparency & board
   G. Review homework sample part - transparency
   H. Mid-term differences

III. Homework - Practice for Mid-Term.

CHABOT COLLEGE

981 - APT Programming - Meeting 7

I. Lab
   A. Editing Exercise
   B. Punch up homework part
   C. Process

II. Lecture
   A. Announcements
      1. Formal - white sheet
      2. Informal
   B. Take Roll
   C. Mid-Term Questions
   D. Conduct Mid-Term
   E. Vectors - Transparencies
   F. Patterns Transparencies

III. Homework
   A. Look over

CHABOT COLLEGE

981A - APT Programming - Meeting 8

I. Lab
   A. Finish up Editing Exercise
   B. Punch-up homework or test part
   C. Process

II. Lecture
   A. Announcements
      1. Formal white sheet
      2. Informal
   B. Take roll
   C. Review Mid-Term
   D. Review Vectors
   E. Finish up Patterns - Transparencies
   F. Pattern Exercises
   G. Planes - Transparencies
   H. Continuous Path
      1. Cutter
      2. Startup

III. Homework
   A. Sample Point-to-Point
   B. Look over Planes, Continuous Path-Cutter and 3 surface startup

CHABOT COLLEGE

981 - APT Programming - Meeting 9

I. Lab
   A. Punch up Test Part
   B. Process
   C. Error Diagnostics
   D. Run Tape on Series I

II. Lecture
   A. Announcements
      1. Formal white sheet
      2. Informal - 3 meetings and final 3/24
   B. Take Roll
   C. Review Patterns - Avoid (Transparencies)
   D. Review Homework (4) tool part
   E. Planes - Transparencies
   F. Continuous Path
      1. Preliminaries
      2. Cutter
      3. Startup
      4. Regular Motion

III. Homework
   A. Look over Section 5 thru page 41
   B. Exercises

CHABOT COLLEGE

981A - APT Programming - Meeting 10

I. Lab
   A. Review Operating Procedure
   B. Finish up Homework Part
   C. Quiz next week on Operating Procedure

II. Lecture
   A. Announcements
      1. Formal white sheet
      2. Informal - Grading
   B. Take Roll
   C. Review Lines & Planes
   D. Continuous Path
      1. Review Point-to-Point
      2. Review Cutter
      3. Review Startup and Regular Motion
   E. Continuous Path Exercises
   F. Review Fill-in Program

III. Homework
   A. Exercises

CHABOT COLLEGE

981 - APT Programming - Meeting 11

I. Lab
   A. Punch-up continuous path, fill-in or new homework part.
   B. Process
   C. Check-out Tapes on Series I

II. Lecture
   A. Announcements
      1. Formal white sheet
      2. Informal - Next Quarter, Manuals, Lockers, Tom in Editing
   B. Take Roll
   C. Review Homework Part
   D. Review Tool Exercises
   E. Review Construction Problem
   F. Review for Final
      1. Points
      2. Z surf
      3. Lines and Planes
      4. Canon
      5. Motion
         a. Point-to-Point
         b. Continuous path.

LAB LAYOUT

BEST COPY AVAILABLE

UCC-APT for Mini Computers

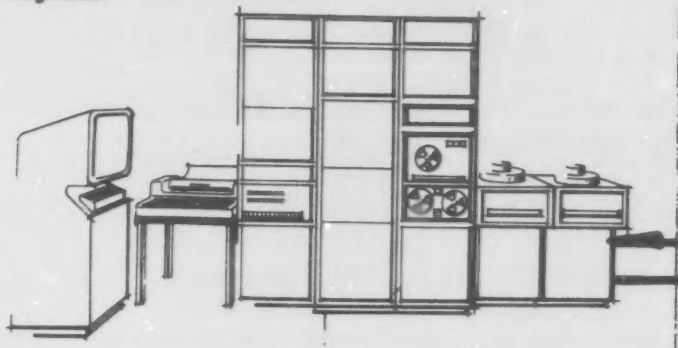
University Computing Company's NC Software is available for in-house mini computers. This is not a scaled-down version of APT, but the complete, fully enhanced language processor . . . UCC-APT.

University Computing Company can structure a hardware/software configuration that will satisfy your current and future NC Processing needs at a significant savings over your current method. At the same time, you gain total control of tape preparation facilities.

Typically, a mini configuration includes a high-speed tape reader, a high-speed Mylar rated punch, remote dial-up terminals, large capacity high-speed disks, and a high-speed line printer, plotter or even graphic CRT's. Your individual needs will dictate the proper configuration.

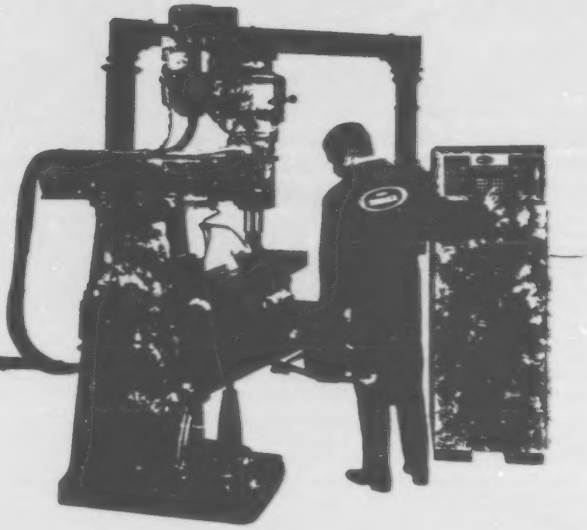
University Computing Company simplifies operations and extends the capabilities of the mini through the use of powerful user-oriented utilities. These utilities provide punched tape verification, automatic job queueing with priority setting, automatic output spooling, error scanning and system libraries (tool, material, etc.). The above utilities greatly enhance the ability to support multiple, simultaneous inter-active terminals.

University Computing Company's configured in-house mini NC tape preparation system offers its users all the benefits found only in large-scale time-sharing processors a few years ago. Simply stated, you get maximum capability at a mini price.



SOFTWARE/COMPUTER CENTER

PART PROGRAMMER



CNC MACHINE OPERATOR

IV.

APPENDIX

			Page
Section A	-	Synopsis of Laws	62
Section B	-	N/C Machines & Controls Manufacturers	68
Section C	-	List of Aids	69
Section D	-	Insurance Coverage	81
Section E	-	Tax Benefits	85
Section F	-	Sample Job Analysis	87

COMPLIANCE

The regulations for section 504 and the Education for All Handicapped Children Act include compliance provisions. Failure to meet the anti-discrimination requirements could result in withdrawal of federal funding.

Neither regulation applies to schools, colleges, or vocational training centers receiving no direct federal assistance and no indirect assistance such as federally insured loans to students. These institutions may choose, however, to make their own commitment to handicapped students and prospective employees on the basis of the requirements for federally assisted institutions.

By Presidential order HEW is the coordinating agency for government-wide implementation of section 504.

WHO IS HANDICAPPED?

In its section 504 regulation, HEW identifies a handicapped person as anyone with a physical or mental disability that substantially limits one or more of such major life activities as walking, seeing, hearing, speaking, working, or learning. A history of such disability or the belief on the part of others that a person has such a disability, whether it is so or not, is also recognized as a handicap by the regulation. Handicapping conditions include, but are not limited to:

- Alcoholism*
- Cancer
- Cerebal palsy
- Deafness or hearing impairment
- Diabetes
- Drug addiction*
- Epilepsy
- Heart disease
- Mental or emotional illness
- Mental retardation
- Multiple sclerosis
- Muscular dystrophy
- Orthopedic, speech or visual impairment
- Perceptual handicaps such as:
  - Dyslexia
  - Minimal brain dysfunction
  - Developmental aphasia

*The U.S. Attorney General has ruled that alcoholism and drug addiction are physical or mental impairments that are handicapping conditions if they limit one or more of life's major activities.

ELEMENTARY AND SECONDARY EDUCATION

Section 504 makes states and local school districts responsible for providing an appropriate education for all physically and mentally handicapped students at public expense. This is true whether schools officials decide a child can best be served in a regular or special education class in the public school, a residential or hospital program, or at home.

As a state or local school administrator, you must:

Conduct a yearly search to locate every disabled child in your state or local district who is not receiving a public education.
HEW-supported programs provide both financial and technical aid to states to identify, locate, and evaluate their disabled children.

Notify parents or guardians of your responsibility for education of their child. State or local organizations for parents of disabled children may be able to help in the notification process.

Provide a free appropriate education regardless of the type or severity of the child's disability.

> For example, you may select a public or private residential program for a child with profoundly disabling cerebral palsy. Although the public school district itself may not be able to pay the extra cost of non-medical care, room, and board, it is responsible for finding these funds from other sources. The important thing is that these services must be provided at no extra cost to parents or guardians.

Place every handicapped child in a program selected after consultation with parents or guardians, teachers, and others who know the child's needs.

> Pre-placement tests must be able to measure the student's educational level despite loss of hearing, sight, or other physical disability.

Place every handicapped child who can benefit in a regular classroom with nonhandicapped students and provide aids needed to compensate for the disability.

> For example, you may have to provide an interpreter for a deaf student in a class taught primarily by lecture.

Periodically evaluate every handicapped student's progress in the program and environment you select.

The Education for All Handicapped Children Act requires that state and local public school administrators:

> Locate every disabled child and young person, age 6-17, living in the state by September 1, 1978, and begin their education at public expense.
>
> If public education is required for children age 3-5, locate them by September 1, 1978 and begin their education at public expense.
>
> If public education is required for disabled youth, age 18-21, locate them by September 1, 1980, and begin an appropriate program for them at public expense.
>
> Give priority attention, first, to disabled children receiving no public education and, second, to the most severely handicapped children in each disability group who are receiving an inappropriate education.

Develop with the advice and consent of parents or guardian an individualized education program for every handicapped student. Each individual program must have a written statement of:

Learning goals developed by a qualified school official with teachers, parents or guardians, and, if possible, the child.

Such special aids needed as braille books for blind children or high desks for children in wheelchairs.

An evaluation of the extent to which the child can participate in regular classroom activities.

A schedule to review periodically the child's progress and, with the consent of parents or guardians, make program revisions as needed.

An explanation of due process procedures available to parents or guardian, including the requirement that schools give them written notice before any action is taken to change a child's program or program location.

Many of these safeguards are already in operation. The Education for All Handicapped Children Act is a 1975 amendment to the basic Education of the Handicapped Act of 1966, which had increasingly specific requirements added by amendments before 1975.

HIGHER EDUCATION

As a college, university, or postsecondary vocational administrator, you may not under the section 504 requirement:

Limit the number of handicapped students admitted.

Use admissions tests or criteria that inadequately measure the academic level of blind, deaf, or otherwise disabled applicants because special provisions were not made to assist them.

Make preadmission inquiries as to whether an applicant is disabled.

An exception is permitted if you are trying to overcome the effects of prior limitations on enrollment of handicapped students and an applicant is willing to provide information about a disability.

You are not required to alter academic standards or those directly related to state licensing requirements.

You may be required to:

Extend the time permitted a handicapped student to earn a degree.

Modify teaching methods and examinations to meet the needs of disabled students.

Assure the availability of such learning aids as audio cassettes for blind students.

SELF-EVALUATION OF ACADEMIC PROGRAMS

If you administer any education program - preschool through graduate school - that receives assistance from HEW, you are required under the section 504 regulation to:

Evaluate, within one year, the quality and availability of your academic programs and related services to handicapped students and begin to correct inadequate policies or practices.

Make the evaluation with the assistance - and expertise - of disabled persons or organizations for disabled persons (see self-evaluation checklists).

PHYSICAL ACCESS TO BUILDINGS

As a school or college administrator, you are not required to provide ramps, elevators, and other devices to remove physical barriers in every building or in every part of a single building

You are required, however, to:

Make every program, viewed as a whole, accessible to handicapped students. To do this, you may need to:

Provide aids, move classes to accessible locations, alter existing structures, or make other accommodations so that disabled students can participate in every program.

Design new buildings to be barrier free

Barrier-free access for disabled persons must be provided in all buidlings where construction began on or after June 3, 1977, the effective date of HEW's section 504 regulation.

EMPLOYING HANDICAPPED PERSONS

As an exmployer covered by the section 504 regulation, you may not discriminate against physically or mentally handicapped persons in:

Recruitment, advertising, or processing of applications for employment.

For example, you may not inquire about any disability an applicant may have or require a physical examination before a job offer is made.

You may require a physical examination once a job is offered if non-handicapped applicants are also required to take it.

This provision is to prevent discrimination against persons with such hidden disabilities as heart disease and epilepsy that would be revealed in a physical examination. It is also to keep employers from requiring a physical examination for handicapped job applicants only - a common practice in the past - then denying them a job because they failed to pass the examination.

You may not discriminate in:

Hiring, promotion, award of tenure, demotion, transfer, layoff termination or rehiring.

Job assignments or career ladders.

Leaves of absence, sick leave, training programs, or other fringe benefits.

Disabled employees who are qualified by ability, training, and experience must be given the same rights and benefits as nonhandicapped employees.

You may be required to make reasonable accommodations to a disability by providing, for example:

A reader for a blind employee who handles paperwork.

An interpreter for a deaf employee whose job requires using a telephone.

Adequate work space for an employee who uses a wheelchair.

Minor adjustment in working hours if an employee is required to visit a methadone clinic daily.

SELF-EVALUATION CHECKLISTS

These are the basic categories that should be examined in performing a self-evaluation of:

Preschool, Elementary, and Secondary Programs

Identification of children in need

Free appropriate public education

Placement procedures

Evaluation

Due process procedures

Non-academic activities

Employment

Building access

Higher Education Programs

Catalogs and other pre-admission literature

Admissions procedures

Access to courses

Academic Adjustments

Auxiliary aids and services

Non-academic activities

Housing

Employment

Building access

BUILDING ACCESS

These are the basic categories that should be examined in performing an architectural accessibility survey:

Site considerations

Parking space
Curb cuts
Sidewalks

Doors

Width
Opening pressure
Threshold

Floors and Halls

Width
Surface covering
Obstructions and hazards

Operating Mechanisms and Controls

Height
Ease of manipulation

Water fountains

Height
Controls

Changes in Level

Ramps
Elevators
Lifts

Rest Rooms

Location
Size
Stall width and depth
Grab bars

Seating

Space for wheelchairs
Traffic circulation

Telephones

Height
Volume control

Numerical Control Machines and Controls Manufacturers

Actron
700 Royal Oaks Drive
Monrovia, Ca. 91016

Allen Bradley Co.
Cleveland, Ohio, 44143

Autonumerics, Inc.
Plant Ave.
Hauppauge, N.Y. 11787

The Bendix Corporation
12843 Greenfield
Detroit, Mich. 48227

Bridgeport Machine Div. of Textron
Bridgeport, Con. 06006

Browne & Sharpe Manufacturing Co.
5827 East Washington Blvd.
Los Angeles, Ca. 90022

Burgmaster-Houdaille
13900 S. Broadway
Los Angeles, Ca. 90061

Cincinnati-Milacron Co.
4701 Marburg
Cincinnai, Ohio, 45209

General Numeric
390 Kent Avenue
Elk Grove Village, Ill. 60006

Giddings & Lewis Machine Tool Co.
142 Doty Street
Fond du Lac, Wis. 54935

Hurco Manufacturing Co. Inc.
P.O. Box 68180
6602 Guion Road
Indianopolis, Indiana, 46268

Jones & Lamson Products
160 Clinton Street
Springfield, Va 05156.

Kearney & Trucker Corp.
11000 Theodore Trucker Way
Milwaykee, Wis. 53214

Kennametal Inc.
P.O. Box 346
Latrobe, Pa. 15650

Lodge & Shipley Company
3055 Colerain Ave.
Cincinnati, OH 45225

Monarch Marhine Tool Co.
c/o H.R.Machinery (Distributors)
20988 Corsaire Blvd.
Hayward, Ca. 94545.

MOOG Hydrapoint Division
P.O. Box 143
Buffalo, N.Y.

Numeridex, Inc.
241 Holbrooke Drive
Wheeling, Ill. 60090

Pratt & Whitney Machine Tool Division
P.O. Box 1680
West Hartford, Conn. 06101

Summit Co.
P.O. Box 1906
Bozeman, MT 59715

Superior Electric Co.
Bristol, Conn. 06012

Warner & Swasey
145 Brook Street
Worcester, Mass.

Wells Index Corp.
1100 W. Broadway Street

White-Sundstrand Machine Tool Inc.
3615 Newburg Road
Belvedere, Ill. 61008.

(Standard Wheel Chair Height)

(1/3 up)

Mainstream Elevating Wheel Chair

Upward Mobility for the Handicapped Person

- ☐ All new concept for handicapped mobility and accessibility
- ☐ Chair seat is fully mobile at all heights
- ☐ At full height, the chair permits eye level contact with a six foot person
- ☐ Conventional facilities no longer need costly modification for handicapped access & use
- ☐ Seat raises 20 inches at the push of a button

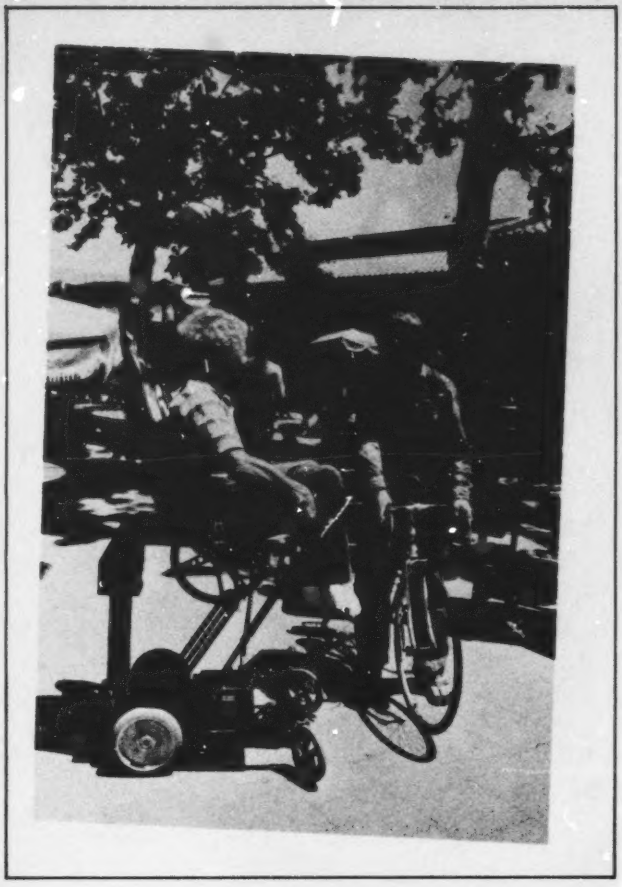
(2/3 up)

(Full Height)

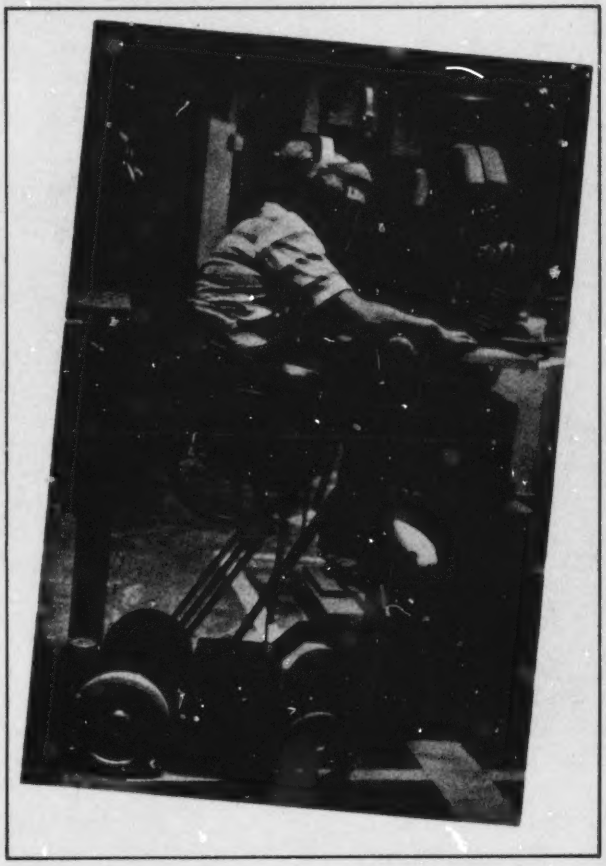
- ☐ Foot rest kinematically draws feet back, allowing for closer proximity to work stations and objects
- ☐ Extremely stable at all heights
- ☐ Seat cover can be removed for cleaning
- ☐ Easy rolling, non-marking grey tires

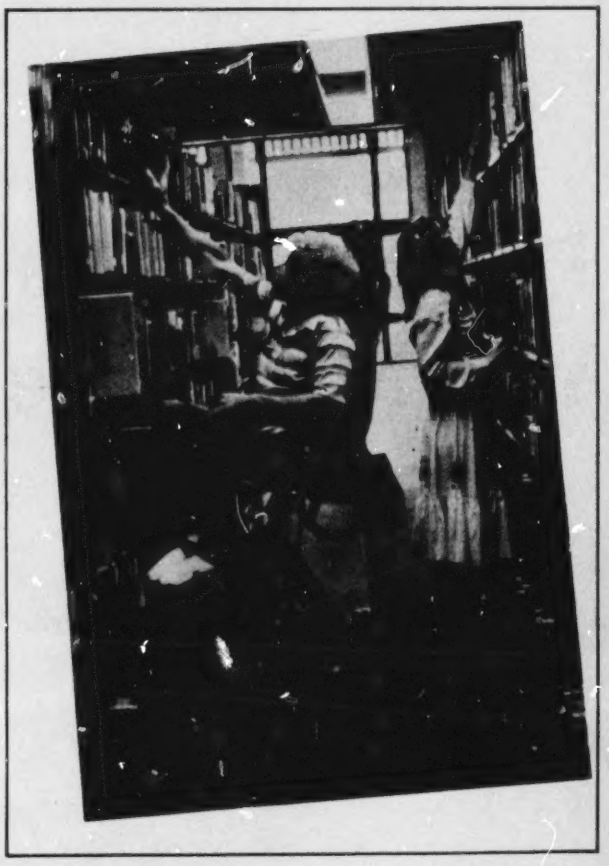
- ☐ Independent living for workers, professionals and students made easy with access to shelves, work tables and equipment
- ☐ Durable construction eliminates costly upkeep
- ☐ Only 24½" wide, fits through all standard doors

SUMMIT SERVICES
535 Division Street, Campbell, CA 95008
or call (408) 378-1251



Imagine the Potential Uses You May Have for the Mainstream Wheel Chair





Sensory Aids for Employment of Blind and Visually Impaired Persons: A Resource Guide

Compiled by
Sensory Aids Foundation

American Foundation for the Blind
New York, 1978

Library of Congress Cataloging in Publication Data

American Foundation for the Blind.
Sensory aids for employment of blind and visually impaired persons.

Includes index.
1. Blind, Apparatus for the. 2. Blind – Employment. 3. Visually handicapped. I. Title.
HV1701.A47 1978 362.4'1'028 78-23887
ISBN 0-89128-083-9

Copyright © 1978 Sensory Aids Foundation / American Foundation for the Blind

Published by American Foundation for the Blind
15 West 16th Street, New York, N.Y. 10011
Printed in the United States of America

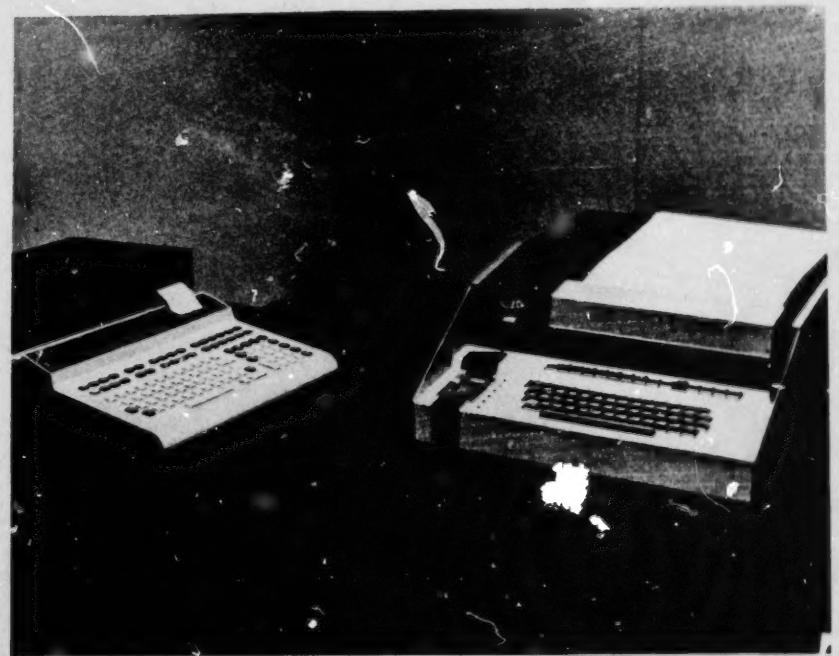
99

Typed Input-to-Grade 1.9 Braille Output

Sighted person with no knowledge of braille can type text into Hewlett Packard 9825 Computer, edit it on the computer visual display, print out in ink print on separate Hewlett Packard printer or print out in Grade 1.9 (not quite Grade 2) braille on compatible braille printer (such as Sagem or Triformation Systems, see listings in this Resource Guide). The print text is converted to braille using a computer program stored on a digital cassette tape and accessed by the HP 9825 from its built-in cassette interface.

Computer program information, contact:

Division of Technical Services
Bureau for the Blind
State Office Building Annex
P.O. Box 758
Frankfort, KY 40602
(502) 564-4754
T. V. Cranmer, Director



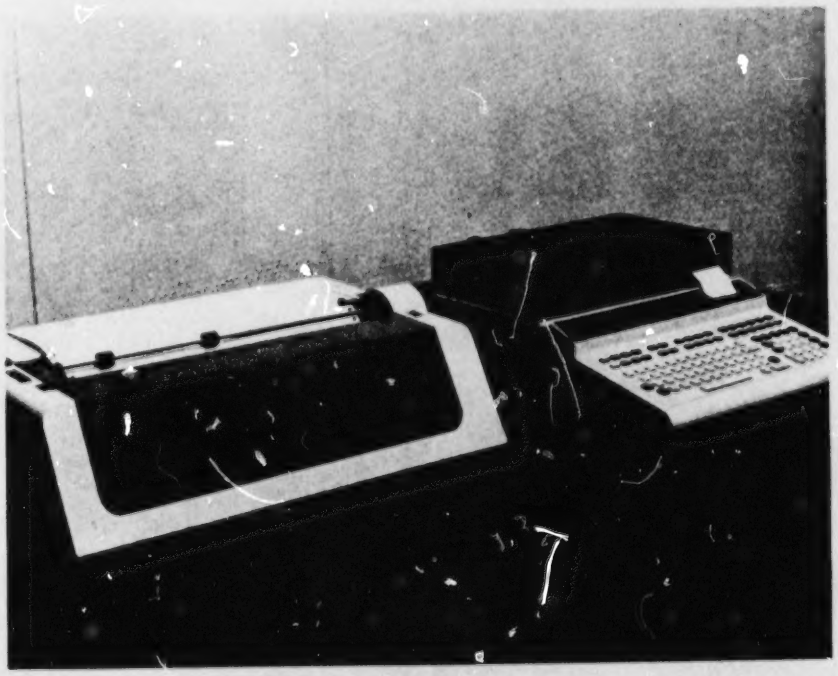
Touch-Audio Display Corresponding to Computer Alphanumeric Visual Display

A row of touch sensitive contact points on a box corresponds to character positions in a line of information on a computer visual display. (The demonstration prototype used a Hewlett Packard 9825 computer with 32 character display.) When touched, selected contact point produces voice output of corresponding letter, number, or character in that position in the visual display. Voice output uses Telesensory Systems Inc. ASCII speech board. Planned expansion of system will allow spoken output of 80-character line, selection of any line on a CRT screen display, spoken output of an entire line of information from a single command, scrolling and reading of first letters or numbers in lines or in columns. Earphone jack permits quiet use in office environment.

Prototype developed by T. V. Cranmer.

For further information contact:

Telesensory Systems Inc.
3408 Hillview Avenue
Palo Alto, CA 94304
(415) 493-2626



101

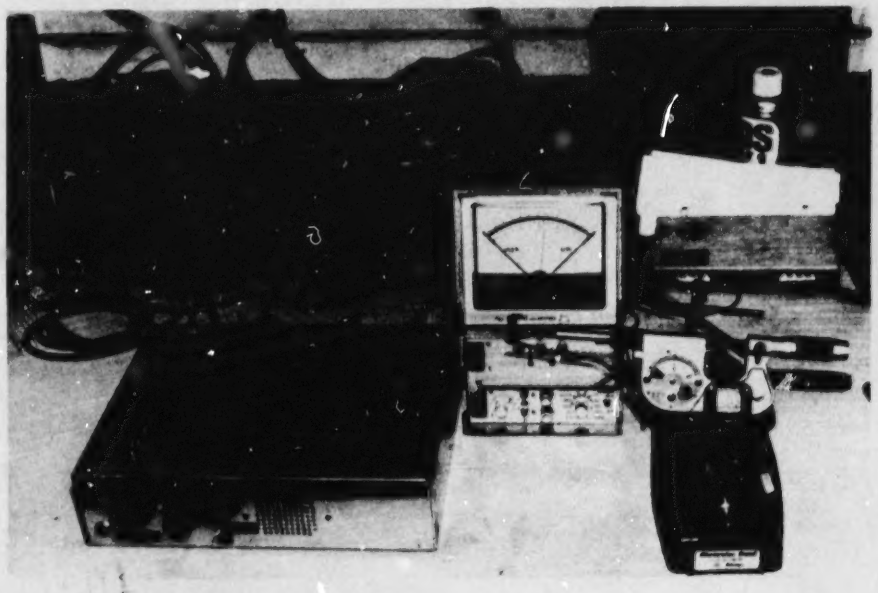
Micrometer, Electronic Dial, With Audio-Tactile Readout

Function: Converts analog (moving needle) meter readout of commercial dial micrometer to tuned tone output with calibrated braille scale.

Employment Application: Machinists, quality control personnel testing tolerances of machined parts; others who make precision measurements.

Description: Consists of an audio-tactile meter-reading device connected to a commercially produced electronic dial micrometer with analog readout. The commercial unit reads the micrometer probe plunger position on its analog meter. These units are available in a number of measurement ranges and probe styles. The audio-tactile meter-reading device is attached to the commercial unit through an available jack. The device has two readouts: 1. A pointer knob which, when turned, causes the speaker to emit a tone which increases in pitch until the measured value is reached. The user then reads the value on the braille scale around the pointer knob. 2. Two screwdriver adjustments that are pre-set from the commercial unit for "plus" and "minus" tolerances of the first measurement. If a measured value is out of tolerance, the adapted unit sets off high or low tone auditory alarms for high or low tolerance excess respectively. Controls include On/Off switches and Volume for both readouts, the pointer knob (which is a calibrated potentiometer) and a braille scale. The commercial unit has a switch to change the scale of the auditory readout box to one of two analog gains. Power: 110 volts AC; also, internal batteries for portable use.

Prototype measures 10" × 12" × 3".



Vendor: Smith-Kettleweli Institute
of Visual Sciences
Rehabilitation Engineering Center
2232 Webster Street
San Francisco, CA 94115
(415) 563-2323
X2475, Bill Gerrey

Availability: Prototype. Documentation available. Query vendor.

Price: Query vendor.

Micrometer, Starrett

Function: Provides accurate measurements of objects placed within its jaws.

Employment Application: Mechanics, machinists, technicians, engineers, workers who make precise measurements.

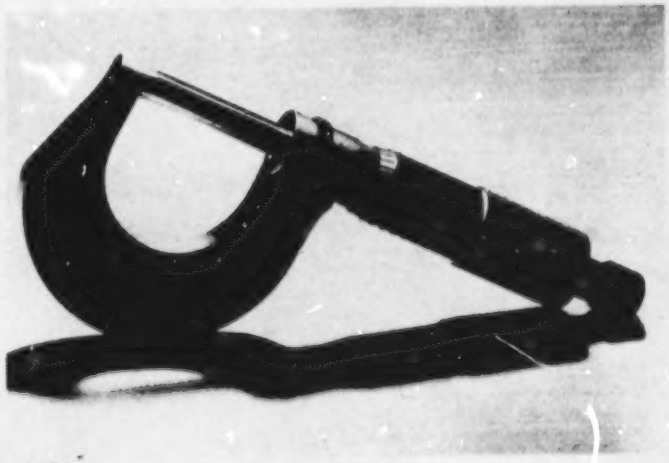
Description: Standard Starrett micrometer modified for fingernail reading. Graduations on thimble have been deepened and raised dots have been added. On the sleeve all graduations are deepened. The .100" graduations appear only over the zero line. The .050" markings are carried below the zero line, while the .025" and .075" markings appear above the zero line. Thus the operator can quickly determine in which .025" division the measurement falls and can then determine the final measurement to within a thousandth of an inch. There are no numeral markings.

Vendor: American Foundation for the Blind
15 W. 16th Street
New York, NY 10011
For aids and appliances information: (212) 620-2170

Availability: Stock.

Price:

Model No.	Weight	Range	Price
TM206	8 oz.	0"-1"	$ 80.30
TM207	1 lb.	1"-2"	$ 88.45
TM208	1 lb.	2"-3"	$ 90.30
TM209	1½ lb.	3"-4"	$101.10



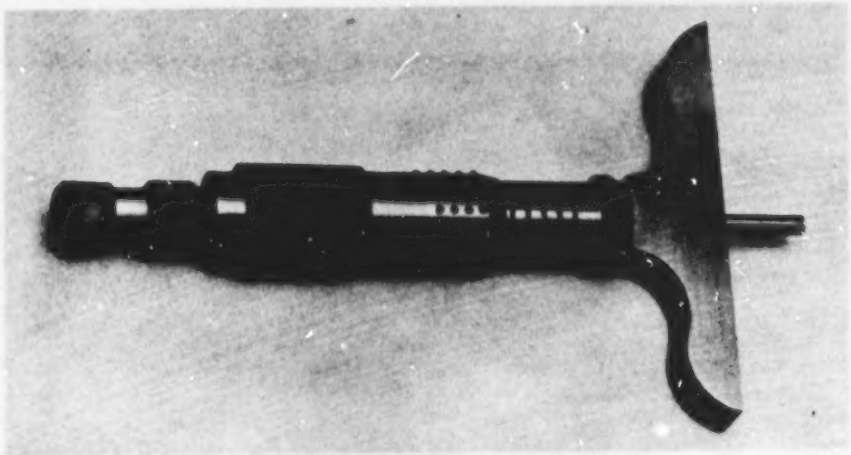
Micrometer, Starrett Depth, TM210

Function: Measures depths or distances where the conventional micrometer will not work, such as car cylinders, pipes, etc.

Employment Application: Used by workers who need precise measurements of distance or interior dimensions—machinists, mechanics, engineers.

Description: Modification of the standard Starrett micrometer for fingernail reading (see p. 83). Graduations on thimble have been deepened and raised dots have been added. On the sleeve all graduations are deepened. The .100" graduations appear only over the zero line. The .050" markings are carried below the zero line, while the .025" and .075" markings appear above the zero line. Thus the operator can quickly determine in which .025" division the measurement falls and can then determine the final measurement to an accuracy within a thousandth of an inch. There are no numeral markings. Interchangeable rods provide 0" to 3" measurements. Weight: 1½ lbs.

Vendor: American Foundation for the Blind
15 W. 16th Street
New York, NY 10011
For aids and appliances information:
(212) 620-2170

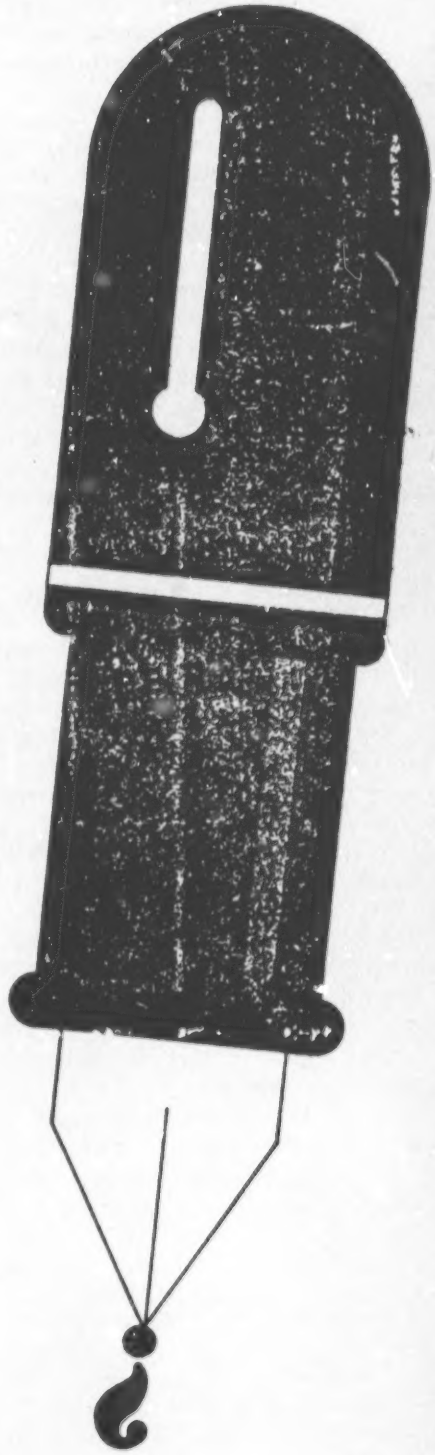


Availability: Stock.

Price: $109.40

105

What Happens to Insurance Rates When Handicapped People Come to Work?



My SPECIFIC JOB IS managing a program which tries to get our disabled policyholders and claimants back to work. That isn't always possible. When it isn't, we try to use rehabilitation at least to bring people back to the point where they can live as independently as possible. CNA Insurance didn't start this program out of any sense of civic responsibility. We did it mainly because it is good business, and it saves money.

You see, we pay out hundreds of thousands of dollars in claims everyday to replace lost income and pay for medical expenses incurred by our policyholders and claimants. We realized some time ago that it is much less expensive to invest some of these claim dollars in physical and vocational rehabilitation, even where the policy does not provide such benefits, than it is just to pay disability benefits to people for the rest of their lives.

First, let me discuss Worker's Compensation insurance because this is an area where there seems to be a lot of confusion. The talk goes something like this: "I would like to consider hiring handicapped workers, but my insurance company won't let me." Or, "I really cannot afford to hire handicapped workers. If I do, my Worker's Compensation rates will go sky high."

I've heard those questions, too. The facts are that Worker's Compensation premium rates depend mainly on two things:

1. The nature of the business involved (some industries are inherently more hazardous than others).
2. The accident record of the individual employer.

There are some other factors, like the number of people employed and the State or location of the business. Everything else being equal, however, it is those two factors which determine the premium rates. Obviously, insurance companies don't tell employers whom they should or should not hire. They are not even consulted about it, as a rule. It is inconceivable that the insurance industry would be spending money to rehabilitate and place disabled workers if they thought the result would be more industrial accidents and higher claim costs.

I can tell you:

1. Your Worker's Compensation premium rates will not go up solely because you hire handicapped workers.
2. The insurance industry does not oppose but actually encourages the employment of handicapped workers.

Reprinted from *Disabled USA*
Vol. 1, No. 8 1978

California Governor's Committee
for Employment of the Handicapped
800 Capitol Mall
Sacramento, CA 95814

3. You are not required to get advance approval from your Worker's Compensation insurer before hiring handicapped workers.

So insurance rates mainly are based on the safety records of workers. This brings up the question: How safe are handicapped workers in general?

Let's look at the record. Every survey I have ever seen indicates that adequately trained and properly placed, handicapped workers are just as safe, if not indeed safer, than any other group of workers.

Back in 1948, the Bureau of Labor Statistics did a study comparing the performance of 11,000 severely handicapped workers with that of 18,000 non-handicapped workers doing the same kind of work. Both groups had some injuries. The handicapped workers turned out to have the same minor injury rate as the so-called normal group (accidents requiring first aid only), and actually suffered fewer disabling injuries than the "normal" group.

More recently, the DuPont Company did a study of all of their known handicapped employees which numbered 1,452 out of their total U.S. work force of some 100,000 employees. This group included workers with orthopedic problems, blindness, heart disease, poor vision, amputations, paralysis, epilepsy, and total or partial deafness. They were employed in a wide range of jobs. Fifty-one percent of the handicapped employees rated above average in safety both on and off the job, another forty-five percent average, and only four percent below average.

Statistics don't tell the entire story, because you cannot apply them to individual cases. One percent unemployment sounds great, but it doesn't help much if I'm the one out of a job. Certainly not every handicapped employee can perform safely in any job. You wouldn't place an employee with uncontrolled epilepsy in a job where he could be injured by machinery if he developed a seizure. This same employee might excel in an office job where an infrequent seizure would not present any significant safety hazard.

This brings up another question: Can the insurance industry give employers any kind of guidance on job safety and proper job placement?

Part of the service you pay for when you buy Worker's Compensation insurance is the expertise of safety engineers and occupational health specialists who work in the Loss Prevention Departments of insurance companies. An important part of their work is to assist with safety programs.

Why not call upon your insurance company's safety experts if you do have some questions about what is necessary to perform any particular job safety? You might as well get the service you are paying for.

They will not usually tell you whether or not you should hire a specific employee. They can, however, advise you on what general skills are necessary for the safe performance of any particular job by an employee, handicapped or not.

Now, how about explaining second injury provisions?

One factor which has deterred some employers from hiring qualified handicapped workers is the fear that if such a worker did suffer an injury on the job, the resulting disability might be much more severe than it would be for an employee without a previous handicap. A worker losing an eye, for instance, could generally recover and go back to most jobs. If the same employee had only one eye to begin with, the result of the accident would be total blindness which might qualify the employee for permanent and total disability benefits under the Worker's Compensation Act.

This fear of extraordinary liability for an injury of a previously handicapped employee caused so much unemployment for returning war veterans after World War II, that it led to the start of second or subsequent injury provisions under State Workers Compensation Laws.

These provisions relieve the employer of liability for the cumulative effect of an injury with a previous disability, and charge him only for the degree or percentage of disability which would have resulted from the last injury alone had there been no pre-existing disability. The balance of benefits paid to the injured worker comes from a Statewide second injury fund instead of the employer or his insurance company.

All 50 States and the District of Columbia now have a second injury fund built into their Workers Compensation Law. I must caution you that these second injury provisions and the way they are applied vary greatly from one State to another.

Since the primary purpose of second injury laws is to encourage employers to hire handicapped workers, most States require the employer to document or prove that they were aware of the previous handicap at the time they hired the employee or retained him in their employ after an accident, in order to get second injury fund payments for a subsequent injury.

Another topic that concerns employers is health insurance coverage. How is it affected when handicapped people go to work?

Health insurance is quite common as a fringe benefit, either provided voluntarily by the employer or as a result of collective bargaining with a union. The employer may pay for either all or part of such coverage for either employees alone, or for employees and their families.

Let's consider the question of whether health insurance is even available to handicapped people. Some of them could have a problem buying health insurance under an individual policy; but they are treated just the same as any one else for group insurance purposes. The answer is yes, health insurance is available.

Let me explain. Insurance companies can be selective on the basis of past health history in selling individual policies. If they could not, I'm afraid nobody would buy such insurance until they got sick and intended to use it. The selection of customers would be very much against

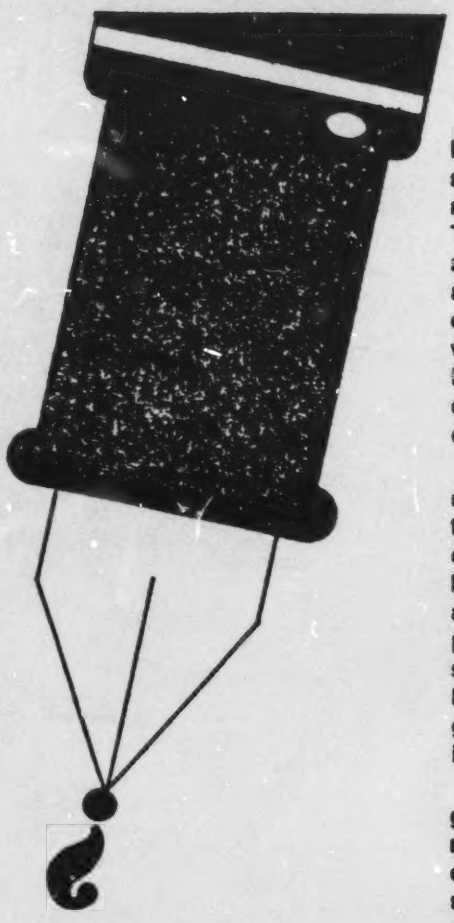
the insurance company.

Employees are eligible for group insurance without answering questions about their past health, but only when they are first employed or otherwise become an eligible member of the group. They cannot wait until they get sick to buy it. Since the insurance company gets all or most of a group's members, the risk is spread a little more broadly and the insurance company can afford to insure everyone in the group on the same basis.

Will handicapped workers cause an employer's group insurance rates to go up? That's a question I cannot answer without some "if's, ands, and buts." Group insurance rates will not go up automatically just because handicapped workers are included, but group insurance like Workers Compensation is often experience-rated.

Premium rates are based at least to some extent on the previous losses of the specific group involved. The degree to which this enters into the rate depends on the size of the group and its past experience in predicting future losses. Because there is no standard formula, there is variation between one insurance company and another in the rates for group insurance.

If handicapped workers require more personal medical care than



other group members, then rates for the entire group will eventually rise to reflect this experience. People with some types of handicap will incur greater than average personal medical care expenses. That wouldn't always be true.

There is no reason why someone who is blind or deaf or has lost a limb through injury, or has some other static condition, should require any more medical care than anyone else. The situation is different, however, for some people with heart conditions and arthritis, and others with chronic or progressive diseases. They are well enough to perform many jobs, but they may incur higher medical expenses because of their chronic condition.

Even in these cases, though, there might not be any serious effect on the employer's cost. It would depend on what kind of care the plan covers, how comprehensive the benefits are, and whether the employer or the employees pay most of the premium. We should also recognize that a few handicapped employees in a large group won't really have any dramatic impact on the group's overall costs.

If you think you have kept your group health insurance rates down by not hiring handicapped employees, consider the fact that your group insurance plan most likely also includes dependents. Even your healthiest employees or job applicants might have sick dependents at home who are in worse shape than any handicapped employee who is well enough to be working.

—Marvin Brantman

Mr. Brantman is rehabilitation coordinator for CNA Insurance.

Insurance Rising?

There has been a long-standing list of what I would call "reasonable excuses" that employers give for not hiring handicapped job applicants. We readily accept that companies are in business to make money and would not expect an employer to take a loss on any individual or group hired. It's appropriate to take a close look at one of the issues that has often barred qualified people from working - namely insurance.

The facts are clear, but the long range implications are not so simple. Let's first center on the question of Worker's Compensation Insurance. Contrary to rumors, the premium rates depend on: (1) the nature of the business, looking specifically at the risk of injury on the job; and (2) the accident record of the individual employer. The first factor is independent of who is working for the company. A study by Du Pont and, more recently, a study in progress at Lockheed, do not show disabled workers as having any greater propensity toward injury on the job than the general worker population.

The question of health insurance is a little more complicated. The formulas used to set rates are a complex interaction of the company risk rate, the claim history of demographically similar companies, and the claim history of the employer in question. The size of the insured group is a factor. Smaller group rates are determined more by similar company histories, and larger group rates more strongly reflect that specific company's history. The kind of disabilities that employees have may cause rates to rise, but let's look more closely. Disability is not easily defined or clearly understood. People with stable conditions, although severely limiting, such as blindness, paralysis, or deafness do not necessarily require more medical treatment. Disability does not equate illness. People with progressive and debilitative diseases may, however, require extensive treatment, cause substantial claims, and possibly affect rates. They are, however, a small number. As mentioned above, small employer rates are minimally reflective of the individual claim experience, while large employer groups may not necessarily see a rate rise due to slight impact of one or two expensive claims among the large population insured. Let's also not forget that health plans often extend coverage to employees' families, who may be high insurance risks. Hiring practices take no account of this implication.

Finally, let's not ignore the second injury and pre-existing conditions clauses. By law, the employer is relieved of liability for the cumulative effect of an injury with a previous disability and is responsible only for the degree of disability which results from the last injury alone, had there been no pre-existing condition. Health benefit programs are limited in liability for conditions that exist when coverage takes effect. So it seems the employer's wisest and safest position is that of equal opportunity and affirmative action, allowing for honesty and accurate information from newly hired employees.

People Are Funny

I have seen the following excerpts from accident reports published in a number of newspapers. Their true source has gotten lost, but the richness of the humor is worth sharing. They must be true because no one could make up some of these explanations.

I thought my window was down, but I found it was up when I put my hand through it.

The guy was all over the road; I had to swerve a number of times before I hit him.

I pulled away from the side of the road, glanced at my mother-in-law, and headed over the embankment.

In my attempt to kill a fly, I drove into a telephone pole.

I had been driving for forty years when I fell asleep at the wheel and had the accident.

To avoid hitting the bumper of the car in front, I struck the pedestrian.

My car was legally parked as it backed into the other vehicle.

An invisible car came out of nowhere, struck my vehicle and vanished.

I told the police that I was not injured, but on removing my hat, I found that I had a fractured skull.

Copy of letter from: THE CALIFORNIA GOVERNOR'S COMMITTEE
FOR EMPLOYMENT OF THE HANDICAPPED

-- Tax Credit for Employing Handicapped Workers --

Targeted Jobs Tax Credit (TJTC)

The Revenue Act of 1978 established the Targeted Jobs Tax Credit (TJTC) which replaced the Vocational Rehabilitation Tax Credit and Jobs Tax Credit which expired December 31, 1978. It also modified the WIN/Welfare Tax Credit which continues in force. A tax reduction is offered to employers incurring wage expenses between January 1, 1979 and December 31, 1980 for certified employees hired after September 26, 1978. The credit is equal to 50 percent of the first year's wages up to $6,000 and 25 percent of such wages during the second year; i.e., the maximum allowable credit for the first year is $3,000, while the maximum allowable credit is $1,500 for the second year. This credit may not be claimed for wages of employees for whom the employer claims the WIN Tax Credit during that taxable year or receives on-the-job training payments.

The eligible targeted groups are.

1. Economically disadvantaged youth (18-24 inclusive).
2. Economically disadvantaged Vietnam-era veterans.
3. Economically disadvantaged ex-convicts.
4. Vocational rehabilitation referral.
5. Youth participating in a cooperative education program.
6. SSI recipients.
7. General assistance recipients.

Eligibility determination will be made by the appropriate agency in each case. Participating agencies include:

CETA Prime Sponsors
Department of Rehabilitation
Cooperative education schools
Social Security Administration
County Welfare Agencies
Veterans Administration

continued.....

Copy of letter from:

The California GOVERNOR'S COMMITTEE FOR EMPLOYMENT OF THE HANDICAPPED

Following determination of eligibility, the participating agency will prepare the TJTC Vouncher and the Applicant Characteristircs form and forward a copy to the Employment Development Department field office in the area to issue an Employee Certification form. These forms must be filled out and filed correctly to validate the tax credit.

By this act, the WIN/Welfare Tax Credit was also extended, providing for the same certification process but increased tax allowances. The allowable tax credits are equal to those of the TJTC for employers in trade or business and 35 percent of the first $6,000 for the first year for non-business employers (generally those who employ people in their homes).

The Revenue Act of 1978 provides great incentives to employers to consider handicapped people for employment. More information is available from your local offices of the California State Employment Development Department or the U.S. Internal Revenue Service or California State Department of Rehabilitation.

The California Employment Development Department maintains a toll free number, (800) 952-5605 for California employers to call for detailed information.

(SAMPLE) JOB ANALYSIS

Job Title Numerical Control Machine Operator

DOT Code 609.662-010

Industry Machine Shop

Firm X Machine Company, Hayward

Contact X

The purpose of this Job Analysis is to aid in determining the feasibility of the vocational goal of Numerically Controlled Machine Operator-Programmer for this client.

Contact: X Machine Company is a non-union machine shop in Hayward which accepts jobs on assignments from producers of electronic devices, automobiles, and a variety of other products. This shop produces small parts for computers, electronic devices, and automobiles, and work exclusively with aluminum, wood, and brass. This shop has three numerically controlled machines which perform a number of machining operations, along with a variety of other machines, such as lathes, drills, milling machines, grinders, and saws.

Job Summary

The N.C. Machine Operator sets up and operates a numerically controlled machine, which performs a number of machine operations. The operator must bolt a vise to the machine, using a wrench to tighten it. This vice will hold a small parts which is to be machined. The vise weights 35 - 50 pounds according to Mr. X. He states that some jobs may last for 10 days so that the vise would not have to be changed in all of that time, but there are some days when it would have to be lifted and changed as many as five times. The worker must position correct cutting tolls in the machine. (S)he then picks up a small piece of aluminum, brass, or wood from a cart, removes the plastic bag from the part, and positions it correctly in the vise on the NC Machine, turning clamps to secure it. In this shop, the part which the worker would pick up and place on the machine weighs a maximum of 7 pounds and usually weights one to three pounds. The operator's usual position would be facing the NC Machine, so (s)he must turn and reach beind him/her to pick up the parts from a cart.

The operator places the correct control tape into the control console and punches in instructions to start the machine. The control console is at a height of about five and one half feet and the machine bed is at a height of approximately four feet.

The operator observes the operation of the machine as it automatically processes the work piece. He may have two or three other machines going at once, since the cycles for each of the work pieces will vary according to the machining operation that is required. The cycles may be short as a minute and as long as one hour and fifteen minutes. The operator may also have other operations to perform while one work piece is being machined. These operations may be "tapping" (drilling holes, filing or deburring, or chamfering),cutting a groove or beveling an edge.

At the end of the cycle of the NC Machine, the operator moves the work piece and checks the accuracy of the machining by measuring the cuts with micrometers and gauges. The operator may adjust the machine controls to specifications when the automatic programming is faulty or when the machine malfunctions. Other job duties for most of the workers in this shop may include using a lathe, mill, cold saw, or other machines in the shop. Also, at the end of the day, the operators sweep up and mop the floor. Under ordinary circumstances, all of the operators in this shop learn to use all of the machines available. Mr. X does train apprentices, so he is quite concerned that they get as broad a base of knowledge about machine work as possible.

PHYSICAL DEMANDS FORM

JOB TITLE Numerical Control Machine Operator OCCUPATIONAL CODE 609.662-010

PHYSICAL ACTIVITIES

1) Walking - occasionally from machine to machine, distances of about 20 feet.

2) Jumping

3) Running

4) Balancing

5) Climbing

6) Crawling

7) Standing - throughout the day. Stools are available, but Mr. X feels that most work really cannot be done from a sitting position.

8) Turning - when reaching for work pieces which are on a cart behind the operator.

9) Stooping

10) Crouching

11) Kneeling

12) Sitting - is a possibility for at least part of the work day, but in this shop the workers ordinarily do not sit while working.

13) Reaching - for the small work pieces.

14) Lifting - a vice weighing 35 - 50 pounds and positioning it on the machine bed at a height of four feet.

15) Carrying - the vice approximately ten feet.

16) Throwing

17) Pushing - on wrenches and clamps when bolting the vice to the machine bed or when positioning work pieces in the vice.

18) Pulling

19) Handling - work pieces vary in sizes.

20) Fingering - control buttons of the NC Machine

21) Feeling - the finished work pieces for rough edges and flaws.

22) Talking

23) Hearing

24) Seeing - and observing the operation of the NC Machine, when checking the finished work pieces against specifications, and when performing finishing operations on the work pieces.

25) Color Vision

26) Depth Perception

27) Working Speed - moderate.

PHYSICAL DEMANDS FORM

WORKING CONDITIONS

1)	X	Inside	
2)		Outside	
3)		Hot	
4)		Cold	
5)		Sudden Temperature Changes	
6)		Humid	
7)		Dry	
8)		Wet	
9)		Dusty	
10)		Dirty	
11)		Odors	
12)	X	Noisy	
13)	X	Adequate Lighting	
14)	X	Adequate Ventilation	
15)	X	Vibration	
16)	X	Mechanical Hazards	
17)		Moving Objects	
18)		Cramped Quarters	
19)		High Places	
20)		Exposure to Burns	
21)		Electrical Hazards	
22)		Explosives	
23)		Radiant Energy	
24)		Toxic Conditions	
25)		Working With Others	
26)	X	Working Around Others	
27)		Working Alone	

Environmental Conditions

This shop appears to be quite clean and there are no tools or debris lying around on the floor. Hazards are from moving parts of the machines used and from metal scrappings flying from the work pieces as they are machined. There is some hazard of eye injury from the air hoses used to clear away some scrap from the finished work pieces. Safety glasses are provided for the workers.